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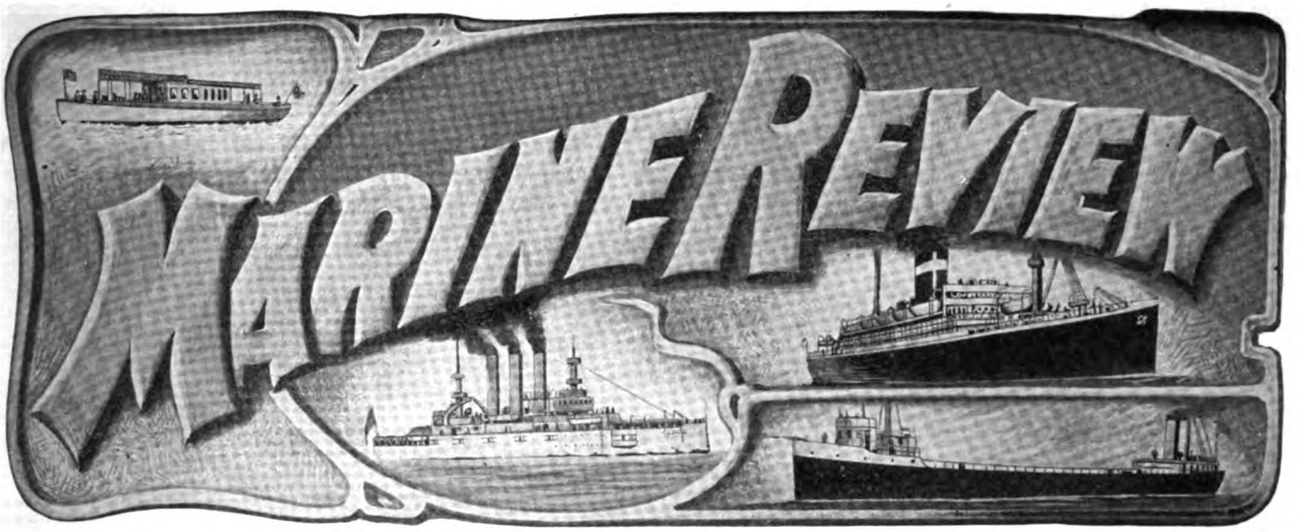

VOL. XXXIII. CLEVELAND, JANUARY 4, 1906. NO. 1.

Ship Building on the Lakes.

In the ship yards of the great lakes, exclusive of the Canadian yards, there are thirty-nine vessels under order for 1906 delivery, of which thirty-four are bulk freighters, two are package freighters, two are car ferries and one a passenger steamer. The significant thing about this building program is that a fair part of it was ordered early last summer, a thing unprecedented in the history of the great lakes, as new vessels are not usually contracted for until late in the fall, when the volume of next year's commerce can be more accurately gauged. With the exception of two 6,500-ton freighters, the thirty-four vessels under order have carrying capacities ranging from 8,000 to 12,000 tons, the thirty-four freighters having a carrying capacity on a single trip of 338,000 tons. The average carrying capacity of the modern freighter on the great lakes has grown so fast that it is now almost double what it was even as late as three years ago. Confined to the ore trade, these thirty-four new freighters will be able to move in a season approximately 6,760,000 tons of ore. These figures of course, take into account only those vessels now actually on the stocks. The shipbuilders of the great lakes during the year 1905, put into the water twenty-eight steamers. These are all in commission with the exception of a few launched after the season of navigation was closed.

A very important element has latterly entered the ship owning field. When the Steel Corporation was formed it acquired through its constituent companies 112 vessels. A year ago it sold sixteen of the smaller of its vessels and placed orders with the American Ship Building Co. for four steamers to be the largest on the lakes. These steamers were 569 ft. over all, 549 ft. keel, 56 ft. beam and 31 ft. deep, and are now in commission. The Steel Corporation has recently given to the American Ship Building Co., orders for four additional steamers to be even larger than their predecessors. They are to be 600 ft. over all, 580 ft. keel, 58 ft. beam and 32 ft. deep, and are to have a carrying capacity of 12,000 tons. Other steel-making companies have not been slow to appreciate the importance of owning vessel tonnage, for the Jones & Laughlin Steel Co., of Pittsburg has given important orders to the Great Lakes Engineering Works, and the Cambria Steel Co., of Philadelphia, to the American Ship Building Co. The leading particulars of all these steamers will be found in the ship building table.

The ship yards of the great lakes have really never had the volume of work on hand that they have today. They are not only blessed with a prodigality of orders for new ships, the like of which has never been experienced before, but the elements too, have served to enrich them, for the last great storm on Lake Superior beached nearly a score of modern steel steamers, and made extensive repairs necessary upon all of them.

Two important changes have occurred in the ownership of lake ship yards during the year. The Great Lakes Engineering Works, which had leased the plant of the Columbia Iron Works, at St. Clair, later purchased it outright, and the Craig ship yard at Toledo passed into the hands of a new company altogether, known as the Toledo Ship Building Co. The financial men in the new company are Lyman C. Smith and H. S. Wilkinson, of Syracuse, and its president and manager are Alexander McVittie and C. B. Calder, respectively, both formerly connected with the Detroit Ship Building Co. This new company is now completely modernizing the Craig ship yard, and will shortly let contracts for the construc-

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tion of a new dry dock, and will eventually build another one and lengthen the present dry dock to accommodate the largest type of lake vessel. It starts in life under the most favorable auspices, as it has an abundance of capital and an assurance of employment in the construction of new ships, and the repair of old ones.

The Canadian ship yards are also busy, the Canadian Ship Building Co., of Toronto, having a car ferry to build for the Ontario Car Ferry Co.

Vessels under Construction on the Great Lakes for 1906 Delivery

AMERICAN SHIP BUILDING CO.'S YARDS

To be built at	Type	Dimensions in ft. Over all	Keel	Beam	Depth	No. of Hatches	Spaced Centers, ft.	Dimensions of Engines	Boilers, dimensions in feet and inches	Draft	Steam Pressure, Pounds	Capacity, Gross Tons	For whom building
Cleveland....	Car Ferry	350	338	54	19 6	....	....	Two 19, 33, 52-38.....	13.9 x 12	Natural	175	.....	Marquette & Bessemer Dock & Nav. Co.
Cleveland.....	Freighter..	524	504	54	30	30	12	23½, 38, 63-42	14.6 x 11.6	Ellis & Eaves	180	9,000	Wilson Transit Co., Cleveland.
Lorain	Freighter .	545	525	55	31	16	24	22½, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	....	10,000	Capt. John Mitchell, Cleveland.
Lorain	Freighter.	545	525	55	31	16	24	22½, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	....	10,000	Capt. John Mitchell, Cleveland.
Bay City.....	Freighter.	534	514	54	31	16	24	22¼, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	180	9,500	Gilchrist Transportation Co., Cleveland.
Bay City.....	Freighter.	534	514	54	31	16	24	22½, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	180	9,500	Gilchrist Transportation Co., Cleveland
Wyandotte....	Freighter.	500	480	52	30	14	24	22½, 36, 60-42.....	13.9 x 11.6	Howden	180	8,000	Hugh McMillan, Detroit.
Wyandotte....	Freighter.	524	504	54	30	30	12	22¼, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	180	9,000	E. D. Carter, Erie, Pa.
Cleveland.....	Freighter..	500	480	52	30	14	24	22½, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	180	8,000	W. C. Richardson, Cleveland.
Lorain	Freighter..	545	525	55	31	32	12	23¼, 38, 63-42	14.6 x 11.6	Ellis & Eaves	180	10,000	H. A. Hawgood, Cleveland.
West Superior	Freighter..	545	525	55	31	32	12	23½, 38, 63-42.....	14.6 x 11.6	Ellis & Eaves	180	10,000	W. A. Hawgood, Cleveland.
West Superior	Freighter..	545	525	55	31	32	12	23½, 38, 63-42.....	14.6 x 11.6	Ellis & Eaves	180	10,000	H. H. Oakes, Detroit.
Detroit.....	Freighter..	569	549	56	31	34	12	24, 39, 65-42.....	15.4 x 11.6	Ellis & Eaves	180	11,000	H. S. Wilkinson, Syracuse.
Detroit.....	Freighter..	500	480	52	30	28	12	22¼, 36, 60-42.....	13.9 x 11.6	Ellis & Eaves	180	8,000	C. O. Jenkins, Cleveland.
Bay City.....	Freighter..	569	549	56	31	34	12	24, 39, 65-42.....	15.4 x 11.6	Ellis & Eaves	180	11,000	W. M. Mills, Tonawanda, N. Y.
Chicago.....	Freighter..	600	580	58	32	36	12	24, 39, 65-42.....	15.4 x 11.6	Ellis & Eaves	180	12,000	Pittsburg Steamship Co., Cleveland.
Chicago.....	Freighter..	600	580	58	32	36	12	24, 39, 65-42.....	15.4 x 11.6	Ellis & Eaves	180	12,000	Pittsburg Steamship Co., Cleveland.
Lorain	Freighter..	545	525	55	31	32	12	23½, 38, 63-42.....	14.6 x 11.6	Ellis & Eaves	180	10,000	W. A. and A. H. Hawgood, Cleveland.
Cleveland.....	Freighter..	552	532	56	31	32	12	23½, 38, 63-42.....	14.6 x 11.6	Ellis & Eaves	180	10,000	Henry Hawgood, Cleveland.
Cleveland.....	Pkg F'hter	256	242	43	26 6	....	....	17½, 25½, 37, 54-36	12.6 x 11.6	Ellis & Eaves	180	3,000	Rutland Transit Co.
Cleveland.....	Pkg F'hter	256	242	43	26 6	....	....	17½, 25½, 37, 54-36	12.6 x 11.6	Ellis & Eaves	180	3,000	Rutland Transit Co.
Cleveland.....	Freighter..	440	420	52	28	28	12	22, 35, 58-40.....	13.9 x 11.6	Ellis & Eaves	180	6,500	W. H. Becker, Cleveland.
Detroit.....	Freighter..	550	530	60	31	32	12	23½, 38, 63-42.....	14.6 x 11.6	Ellis & Eaves	180	10,000	Pickands, Mathers & Co., Cleveland.
Chicago.....	Freighter..	600	580	58	32	36	12	24, 39, 65-42	15.4 x 11.6	Ellis & Eaves	180	12,000	Pittsburg Steamship Co., Cleveland.
Chicago.....	Freighter..	600	580	58	32	56	12	24, 39, 65-42.....	15.4 x 11.6	Ellis & Eaves	180	12,000	Pittsburg Steamship Co., Cleveland.
Lorain	Freighter..	440	420	52	28	28	12	22, 35, 58-40.....	13.9 x 11.6	Ellis & Eaves	180	6,500	W. H. Becker, Cleveland.
West Superior	Freighter..	600	580	58	32	....	....	24, 39, 65-42	15.4 x 11.6	Ellis & Eaves	180	12,000	Cambria Steel Co., Philadelphia.
Bay City.....	Freighter..	600	580	58	32	....	....	24, 39, 65-42.....	15.4 x 11.6	Ellis & Eaves	180	12,000	Cambria Steel Co., Philadelphia.
Cleveland.....	Freighter..	552	532	56	31	32	12	23½, 38, 63-42.....	14.6 x 11.6	Ellis & Eaves	180	10,000	Hawgood, Cleveland.

GREAT LAKES ENGINEERING WORKS, DETROIT

Ecorse	Freighter..	550	530	56	31	33	12	23, 37, 63 x 42....	Two 15 x 12...	Induced	175	10,000	Globe Steamship Co.
Ecorse	Freighter.	550	530	56	31	33	12	23, 37, 63 x 42....	15 x 12...	Induced	175	10,000	Jones & Laughlin Steel Co.
Ecorse	Freighter..	550	530	56	31	33	12	23, 37, 63 x 42....	15 x 12...	Induced	175	10,000	Jones & Laughlin Steel Co.
Ecorse	Freighter..	550	530	56	31	33	12	23, 37, 63 x 42....	15 x 12...	Induced	175	10,000	Shenango Steamship Co.
Ecorse	Freighter.	550	530	56	31	33	12	23, 37, 63 x 42....	15 x 12...	Induced	175	10,000	Cleveland Cliffs Iron Co.
Ecorse	Freighter.	550	530	56	31	33	12	23, 37, 63 x 42....	15 x 12...	Induced	175	10,000	Cleveland Cliffs Iron Co.
Ecorse	Freighter.	550	530	56	31	33	12	23, 37, 63 x 42....	15 x 12...	Induced	175	10,000	Cleveland Cliffs Iron Co.
St. Clair	Car Ferry	350	330	56	20			Twin Screw					
St. Clair	Drill Scow	95	44	10				2, 19½, 31, 52 x 36 Special	Four 13-2 x 12. Special	Induced	175	30 Cars	Jas. W. Ellsworth & Co. Dunbar & Sullivan Dredge Co.

TOLEDO SHIP BUILDING CO., TOLEDO.

Toledo	Freighter..	500	480	52	30	14	24	15, 23, 36, 55-40	12.6 x 11.9	.....	....	8,000	L. S. Sullivan, Toledo.
Toledo	Lighthouse tender...	117.6	125.9	25	11	....	....	16 x 31-24	11 9 x 12	.....	120	.....	Lighthouse Board.
Toledo	Passenger steamer..	289	270	40	16	....	....	30, 48, 56, 56-40	11.6 x 11	.....	200	.....	Indiana Transp'n Co., Michigan City, Ind.

MANITOWOC DRY DOCK CO., MANITOWOC, WIS.

Manitowoc....	Fire Boat..	106	95	23	8	....	....	18 x 20	12 x 15	Natural	140	.....	City of Milwaukee.
Manitowoc....	Dump Scow..	100	....	28	9	....	....	.....	.....	.....	....	250 cu. yd.	.....
Manitowoc....	Dump Scow..	137	...	30	11 6	....	....	.....	.....	.....	....	550 cu. yd.	.....
Manitowoc....	Dump Scow..	137	....	30	11 6	....	....	.....	.....	.....	....	550 cu. yd.	.....
Manitowoc....	Suction Dredge..	148	....	36	10 6	....	....	.....	.....	.....	....	.....	.....

JOHNSTON BROS., FERRYSBURG, MICH.

Ferrysburg....	Tug.....	142	....	25	13	....	....	24 x 44-36	13 x 13	.....	150	.....	Frank Perry, Sault Ste. Marie.

CANADIAN SHIP BUILDING CO., TORONTO.

.....	Quarantine Str.	129	120	26	11 8	....	....	Two 12, 26 x 16	Two Scotch 9 9 x 11	Natural	160	.....	Dominion Government.
.....	Stone Lifter..	100	....	32	10 6	....	....	.....	One Scotch 7 3 x 7	Natural	150	.....	Dominion Government.
.....	Passenger.	317	306	36 6	15	....	....	Two 17½, 25, 36, 52x30	7 Scotch 11 x 12	Forced	210	.....	Niagara Navigation Co.
.....	Passenger.	240	232	41 6	10 6	....	....	.....	.....	.....	....	.....	Rich. & Ontario Navigation Co.
.....	Passenger.	152	146	28 6	9	....	....	Two 10, 16, 26x16	4 Scotch 7 x 11	Natural	175	.....	Muskoka Lakes Nav. & Hotel Co. Ltd.
.....	Car Ferry.	318	306	56	20 6	....	....	Two 20½, 32½, 54x36	4 Scotch 14 x 12	Forced	175	.....	Ontario Car Ferry Co.

POLSON IRON WORKS, TORONTO, ONT.

Toronto.....	Steam yacht....	65	58	10.6	6	....	....	6, 12-8	51 x 72 Vertical submerged tube.	Natural.	150	.....	Canadian Fog Signal Co., Toronto.
Toronto.....	Hydraulic dredge.	90	...	30	6	....	....	8¼, 13¼, 22-16	9 x 10.2½	Natural.	160	.....	City of Toronto.
Toronto.....	Steam yacht.	94	94	12	6	....	....	9, 13, 20½-11	Thorneycroft.	Forced.	300	.....	T. Eaton, Toronto.
Toronto.....	Hydraulic dredge.	137	....	44	10	....	....	14, 22, 36-21	12 x 12.6	Natural.	160	.....	Dominion Government.
Toronto	Passenger steamer.	80	80	18	7.6	....	....	10 x 20-16	Fitzgibbon boiler, 66 x 120	Natural.	155	.....	Maganetawan River & Lakes Steamboat Line, Burk's Falls, Ont.

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United States Naval Program.

There are at present thirty-two ships building for the United States navy as against thirty-eight one year ago. During the year the following war vessels have gone into commission: Armored cruisers Pennsylvania, Colorado, West Virginia, Maryland; protected cruisers, Charleston, Galveston, Chattanooga; torpedo boats Stringham, Blakely, Nicholson and O'Brien; training brig Boxer. The thirty-two ships under construction represent a displacement of 307,565 tons, a horsepower of 402,000 and a monetary value, exclusive of armor and armament, of $82,571,500. Important additions will be made during the year to the naval program in the way of battleships, one of them being probably the heaviest battleship in the world, but the specifications for this program had not as yet been submitted to the ship builders.

The interesting thing about the present program is that two of the scout cruisers are to be equipped with turbine engines, one with four screws and the other with two screws; the third scout will be equipped with the ordinary form of reciprocating engine. Through this policy the navy department will be able to determine not only the relative efficiency of the turbine and the common form of marine engine, but also the form of turbine to be preferred. The naval building program as it stands today consists of thirteen battleships, five armored cruisers, two protected cruisers, two gunboats, two training ships, three scouts, one torpedo boat and four submarines. With the additions to be made during the year the monetary value of the program will exceed $100,000,000.

Merchant work on the coast is not in a flourishing condition, though it is better than it was a year ago. Some important contracts have been given to the coast ship builders for coastwise vessels, a few of them to be equipped with turbine engines. These will be the first merchant vessels to be constructed in the United States equipped with turbines. The turbine steamers now plying in American waters are of British construction. It is now four years since an order was placed with an American ship yard for a vessel for use in the foreign trade. There is no prospect that any such order will be placed with the ship yards until congress removes the handicap under which American shipping operates in the oversea trade. There is some hope that this handicap will be removed during the present session of congress. If it is, the coast ship yards will be immediately crowded with work. Ship building at present in the United States is only really flourishing on the great lakes, where the trade enjoys the double protection of the coastwise laws and of nature, and where an enormous commerce exists which can be moved only by ships.

Vessels under Construction for the United States Navy.

Name.	By whom and where building.	Contract date of completion.	Dimensions, ft., in. Normal condition. Length between perpendiculars.	Breadth on L. W. L.	Mean draught	Displacement (normal).	I. H. P. (estimated.)	Speed, knots (estimated).	Type of engine.	Type of boilers.	Contract price of hull and machinery.
Battleships.											
Nebraska	Moran Bros. Co., Seattle, Wash.	Mar. 7, 1904	435	76 2½	23 9	14,948	19,000	19	Trip.exp., twin screw	Bab. & Wil.	$3,733,800
Virginia	Newport News Co., Newport News	Feb. 15, 1904	435	76 2½	23 9	14,948	19,000	19	Trip.exp., twin screw	Niclausse	3,590,000
Georgia	Bath Iron Works, Bath, Me.	Feb. 18, 1904	435	76 2½	23 9	14,948	19,000	19	Trip.exp., twin screw	Niclausse	3,590,000
New Jersey	Fore River Co., Quincy, Mass.	Feb. 15, 1904	435	76 2½	23 9	14,948	19,000	19	Trip.exp., twin screw	Bab. & Wil.	3,465,000
Rhode Island	Fore River Co., Quincy, Mass.	Feb. 15, 1904	435	76 2½	23 9	14,948	19,000	19	Trip.exp., twin screw	Bab. & Wil.	3,465,000
Connecticut	Navy Yard, New York	Mar. 15, 1906	450	76 10	24 6	16,000	16,500	18	Trip.exp., twin screw	Bab. & Wil.	4,212,000
Louisiana	Newport News Co., Newport News	Mar. 15, 1906	450	76 10	24 6	16,000	16,500	18	Trip.exp., twin screw	Bab. & Wil.	3,990,000
Vermont	Fore River Co., Quincy, Mass.	Dec. 20, 1906	450	76 10	24 6	16,000	16,500	18	Trip.exp., twin screw	Bab. & Wil.	4,179,000
Kansas	New York S. B. Co., Camden, N. J.	Dec. 16, 1906	450	76 10	24 6	16,000	16,500	18	Trip.exp., twin screw	Bab. & Wil.	4,165,000
Minnesota	Newport News Co., Newport News	Dec. 20, 1906	450	76 10	24 6	16,000	16,500	18	Trip.exp., twin screw	Bab. & Wil.	4,110,000
Mississippi	Cramp & Sons, Philadelphia	Mar. 25, 1907	375	77	24 8	13,000	10,000	17	Trip.exp., twin screw	Bab. & Wil.	2,999,500
Idaho	Cramp & Sons, Philadelphia	May 25, 1907	375	77	24 8	13,000	10,000	17	Trip.exp., twin screw	Bab. & Wil.	2,999,500
New Hampshire	New York S. B. Co., Camden, N.J.	Feb. .., 1908	450	76 10	24 6	16,000	16,500	18	Trip.exp., twin screw	Water tube	3,748,000
Armored Cruisers.											
California	Union Iron Works, San Francisco	Jan. 10, 1904	502	69 6¼	24 1	13,680	23,000	22	Trip.exp., twin screw	Bab. & Wil.	3,800,000
South Dakota	Union Iron Works, San Francisco	Jan. 10 1904	502	69 6¼	24 1	13,680	23,000	22	Trip.exp., twin screw	Bab. & Wil.	3,750,000
Tennessee	Cramp & Sons, Philadelphia	Aug. 9, 1906	502	72 10½	25	14,500	23,000	22	Trip.exp., twin screw	Bab. & Wil.	4,025,000
Washington	New York S. B. Co., Camden, N. J.	Aug. 10, 1906	502	72 10½	25	14,500	23,000	22	Trip exp., twin screw	Bab. & Wil.	4,035,000
North Carolina	Newport News Co., Newport News	Jan. 3, 1908	502	72 10½	25	14,500	23,000	22	Trip.exp., twin screw	Bab. & Wil.	3,575,000
Montana	Newport News Co., Newport News	Jan. 3, 1908	502	72 10½	25	14,500	23,000	22	Trip.exp., twin screw	Bab. & Wil.	3,575,000
Protected Cruisers.											
St. Louis	Neafie & Levy, Philadelphia	Mar. 11, 1902	424	66	22 6	9,700	21,000	22	Trip exp., twin screw	Bab. & Wil.	2,740,000
Milwaukee	Union Iron Works, San Francisco	Apr. 17, 1904	424	66	22 6	9,700	21,000	22	Trip.exp., twin screw	Bab. & Wil.	2,825,000
Steel Training Ships.											
Cumberland	Navy Yard, Boston		176 5	45 7¾	16 5¼	1,800			Sail power		370,000
Intrepid	Navy Yard, Mare Island		176 5	45 7¾	16 5¼	1,800			Sail power		370,000
Torpedo Craft.											
Goldsborough	Navy Yard, Puget Sound	Jan. 30, 1899	198	20 7¼	6 10½	255	6,000	30	Trip.exp., twin screw	Thorneycroft	214,500
Scout Cruisers.											
Chester	Bath Iron Works	May 4, 1908	420	47	16 9	3,750	16,000	24	Four screw, turbine	Water tube	
Birmingham	Fore River Ship Bldg. Co.	Nov. 17, 1907	420	47	16 9	3,750	16,000	24	Twin screw, trip.exp	Water tube	
Salem	Fore River Ship Bldg. Co.	Mar. 17, 1908	420	47	16 9	3,750	16,000	24	Twin screw, turbine	Water tube	
Submarines.											
Octopus	The Elec. Boat Co., N. Y.	Sept. 6, 1906									
Viper	The Elec. Boat Co., N. Y.	Sept. 18, 1906									
Cuttlefish	The Elec. Boat Co., N. Y.	Sept. 18, 1906									
Tarantula	The Elec. Boat Co., N. Y.	Sept. 18, 1906									

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Merchant Work in Coast Ship Yards

Newport News Ship Building & Dry Dock Co., Newport News, Va.:

Steel steamer Wm. S. Porter for Associated Oil Co.; length, 385 feet; three-cylinder triple-expansion engine; 3,230 horsepower; gross tonnage, 4,527.

Steel steamer Jamestown for Norfolk & Washington Steamboat Co.; length, 250 feet; two-cylinder compound engine; 2,000 horsepower; gross tonnage, 1,400.

Steel steam ferryboat for the Delaware, Lackawanna & Western Railway Co.; length, 231 feet; double compound engine; 1,400 horsepower; gross tonnage, 1,462.

Submarine torpedo boat (lake type) for Lake Torpedo Boat Co.; gasoline engine.

During the year 1905 the company delivered four ferryboats and two freight lighters to the Delaware, Lackawanna & Western Railroad Co. at New York, besides delivering the armored cruisers West Virginia and Maryland and protected cruiser Charleston, running the official trials of the battleships Virginia and Louisiana and launching the battleship Minnesota.

Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.:

Steel transfer tugs Nos. 19 and 20, duplicates, for the New York, New Haven & Hartford Railroad Co.; length, 110 feet; compound single engine; one Scotch boiler; 1,000 horsepower; gross tonnage, 276.

Steel steamers Merida and Mexico, duplicates, for the New York & Cuba Mail Steamship Co.; length, 400 feet; triple-expansion, twin-screw engines; two double and one single Scotch boilers; 6,000 horsepower; gross tonnage, 7,000.

Steel steamers Comus and Antilles, duplicates, for South Pacific Co.; length, 440 feet; triple-expansion engines; three double and four single Scotch boilers; 7,000 horsepower; gross tonnage, 7,500.

Steel freight and passenger steamer for New York & Cuba Mail Steamship Co.; length, 412 feet; triple-expansion twin-screw engine; 8 single Scotch boilers; 8,500 horsepower; gross tonnage, 7,200.

Steel ice crushing steamer John Weaver for the city of Philadelphia; length, 200 ft.; triple-expansion twin-screw engine; two double and one single Scotch boilers; 3,600 horsepower; gross tonnage, 1,700.

Three steel freight steamers, duplicates, for the Quintard Iron Works; length, 396 feet; triple expansion twin-screw engine; eight single Scotch boilers; 7,600 horsepower; gross tonnage, 3,500. Engines for one of these three steamers not yet decided upon.

Steel freight and passenger steamer for New York & Cuba Mail Steamship Co.; length, 412 feet; triple-expansion twin-screw engine; eight single Scotch boilers; 8,500 horsepower; gross tonnage, 7,200.

Harlan & Hollingsworth Corporation, Wilmington, Del.:

Steel steam double screw ferryboat Crawford for Central Railroad of New Jersey; length 207 feet; one four-cylinder, triple-expansion single screw engine; three gunboat type boilers; 1,500 horsepower, gross tonnage, 1,197.

Steam steel double screw ferryboat Somerville for Central Railroad of New Jersey; length 207 feet; one four-cylinder triple-expansion single screw engine; three gunboat type boilers; 1,500 horsepower; gross tonnage, 1,197.

Steel oil barge for Sun Oil Co. of Philadelphia; length 110 feet.

Steam steel lighthouse tender Sunflower for United States government; length 173 ft.; two triple-expansion, twin-screw engines; two Scotch boilers; 900 horsepower.

Steam steel double screw ferryboat for the Norfolk & Washington Steamboat Co.; length, 190 ft.; one four-cylinder, triple-expansion single screw engine; two Scotch boilers; 1,400 horsepower; gross tonnage 857.

Three steam steel harbor tugs, duplicates, for the Central Railroad of New Jersey; length, 116 ft.; one compound expansion engine; two Scotch boilers; 850 horsepower.

Steel steam wrecking steamer for Merritt-Chapman Wrecking Co.; length, 200 feet; one triple-expansion engine; two Scotch boilers; 1,250 horsepower.

Maryland Steel Co., Sparrow's Point, Md.:

Three steel steam tugs, duplicates, for the Pennsylvania Railroad Co., Philadelphia; length, 105 feet; one engine 18 and 36 by 26 inches; one Scotch boiler, 14 feet 5 inches by 12 feet 8 inches; 560 horsepower; gross tonnage, 200.

Six steel lighters, duplicates, for the Panama Railroad Co., New York; length, 111 ft. 4 in.; gross tonnage 170.

One steam steel lighter for the Pennsylvania Railroad Co., Philadelphia; length 120 feet; one engine, 17 and 34 by 24 inches; one Scotch boiler, 10 feet by 12 feet; 430 horsepower; gross tonnage, 250.

One steel car float for the New York, Philadelphia & Norfolk Railroad Co., Philadelphia; length, 340 feet; gross tonnage, 1,255.

Two oil barges of steel for the Standard Oil Co., New York City; length, 185 feet; gross tonnage, 600.

Fore River Ship Building Co., Quincy, Mass.:

Steel steamer Creole for Southern Pacific Co. (Morgan Line), Pier 34, North River, N. Y.; length, 440 feet; twin-screw Curtis marine turbine engines, 120 inches diameter; ten Babcock & Wilcox boilers; 6,000 tons displacement.

Steel steamer South Shore for Nantasket Beach Steamboat Co., Boston; length, 207 feet 6 inches; one simple beam engine; two single ended Scotch boilers; 1,200 horsepower.

Steam trawler Spray for the Bay State Fishing Co., Boston; length, 126 feet 8 inches; one triple-expansion engine, 12¾-inch x 22-inch x 36-inch x 24-inch stroke; one single ended Scotch boiler; 283.11 tons displacement.

Union Iron Works Co., San Francisco, Cal.:

Steel twin-screw steamers Mexican and Columbian, duplicates, for the American Hawaiian Steamship Co., 8 Bridge street, San Francisco; length, 488 feet 4 inches; three-cylinder triple-expansion engines; four Scotch boilers with Howden forced draft; 4,000 horsepower; gross tonnage, 8,000.

Wooden double end ferryboat with two screws and one fore and aft shaft for San Francisco, Oakland & San Jose Railway Co.; length, 201 feet; two two-cylinder compound engines, 20 and 42 by 28 in.; two Cahill water-tube boilers; 2,000 horsepower; gross tonnage, 1,200. Hull built by John W. Dickie, Alameda, Cal.

One 11-foot D. Scotch boiler by 10 feet 9 inches long for wooden steam schooner Coaster for C. Higgins. Hull built by J. Lindstrom, Grays' Harbor, and engine by United Engineering Works, San Francisco, Cal.; 500 horsepower.

Howard's Ship Yard Co., Jeffersonville, Ind.:

Sternwheel tow boat for use on Ohio river; length, 130 feet; high pressure engine; 150 horsepower.

Side-wheel freight and passenger packet for use on the Mississippi river; length, 250 feet; high pressure engine, 500 horsepower.

Stern-wheel tow boat for use on the Mississippi river; length, 150 feet; 300 horsepower.

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Six sand barges, duplicates, 130 feet long for use on the Mississippi river.

One dredge for use on the Mississippi river, 130 feet long.

James Rees & Sons Co., Pittsburg, Pa.:

Sternwheel freight and passenger steamer S. S. Brown for The Memphis & Vicksburg Packet Co., Memphis, Tenn.; length, 228 feet; tandem compound engine; 800 horsepower; gross tonnage, 1,000; cost $100,000. This boat will have three fore and aft and five athwartship bulkheads in hull, making 18 watertight compartments. The hull plating will be ¼-inch and 5-16-inch and ⅜-inch thickness. The cabin capacity will be 75 first class passengers, 25 second and 100 steerage.

Spedden Ship Building Co., Baltimore, Md.:

Steel tug for themselves; length 118 ft.; fore and aft compound engine, 16 x 32 x 24 stroke.

One triple-expansion engine for themselves, 13⅛ x 21 x 24 inch stroke.

One boiler for tug Walter, Baltimore, 6 feet 6 inches diameter, 12 feet long.

One boiler for tug Camilla, Washington, 6 feet 6 inches diameter, 11 feet long.

One boiler for tug Lucile Ross, Richmond, Va., 6 feet 9 inches diameter, 12 feet long.

One boiler for tug C. Whiteley, Baltimore, 5 feet 6 inches diameter, 10 feet long.

Pusey & Jones Co., Wilmington, Del.:

Steel hull steam yacht for Andrew W. Rose, New York; length, 162 feet; four-cycle triple-expansion engine, 12, 18, 20 and 20 by 15 inches; two Almy water-tube boilers; 800 horsepower.

Wooden hull twin-screw steamer Cristolab Colon for the Isle of Pines Steamboat Co., of New York, to ply between Isle of Pines and Cuba; length, 130 feet; two compound surface condensing engines, 9 and 20 inches by 16 inches; Roberts water-tube boiler, 65 square feet grate surface and about 2,000 square feet heating surface. The hull of this vessel was sub-contracted with the Nelson Yacht Building Co. of Baltimore.

New York Ship Building Co., Camden, N. J.:

Three suction dredges, one for the Atlantic Gulf & Pacific Co. and two for the Empire Engineering Corporation of New York City.

In their boiler department, this company is very busy, working night and day on a large number of shields for East River Tunnel and Scotch boilers for outside parties.

Moran Bros. Co., Seattle, Wash.:

Wooden steam schooner for the Pacific Coast Steamship Co., Seattle; length, 237 feet; three-cylinder single screw engines; Scotch marine boilers; 1,200 horsepower; gross tonnage, 1,000; cost, $150,000.

Rebuilding steel barkentine Lord Wolseley for the Alaska Steamship Co., Seattle; length, 308 feet; sailing ship-rigged six-masted barkentine; gross tonnage 2,700; cost, $50,000.

Gas Engine & Power Co. and Charles L. Seabury & Co., Cons., Morris Heights, New York:

Steel steam yacht Algonquin for E. L. Ford, Detroit, Mich.; length, 140 feet; one triple-expansion engine Seabury type; one water-tube boiler, Seabury type; 400 horsepower; gross tonnage, 140.

Wooden steam launch for Arkell & Douglass, New York City; length 40 feet; one compound engine, Seabury type; one water-tube boiler, Seabury type; 25 horse power; gross tonnage, 10.

One Seabury boiler for the steam yacht Vixen, building for J. D. Archbold of New York City.

Wooden steam yacht "The Limited" for A. C. Bostwick, New York City; length, 98 feet; one triple expansion engine, Seabury type; one water-tube boiler; Seabury type; 400 horsepower; gross tonnage, 50.

Gasoline yacht for E. R. Cornnett, New York City; length, 69 feet; twentieth century engine; 70 horsepower; gross tonnage, 30.

Steel steam yacht; length 108 feet; two triple expansion engines, Seabury type; one water-tube boiler, Seabury type; 500 horsepower; gross tonnage, 100.

Four Seabury patent boilers for the steam yacht American building for A. Watt of New York City.

Two Seabury boilers for steam yacht Velthia building for S. P. Bremer of Boston.

American Car & Foundry Co., Wilmington, Del.:

Wooden Barge for J. W. Paxson Co., Philadelphia; length, 170 feet; gross tonnage 600.

Two dredging scows of wood, duplicates, for A. Mackenzie, New York; length, 125 feet; gross tonnage, 1,100.

Two wooden dredging scows, duplicates, for the Standard Dredging Co., Wilmington, Del.; length, 140 feet; gross tonnage, 1,300.

Five car floats of wood, duplicates, for the Pennsylvania Railroad Co., Jersey City; length, 250 feet; gross tonnage, 1,100.

Two wooden lighters, duplicates, for Chesapeake & Ohio Railroad Co., Newport News, Va.; length, 130 feet; gross tonnage, 600 feet.

George Lawley & Son Corporation, South Boston, Mass.:

Wooden schooner yacht for Alfred Douglas, 170 West 59th street, New York; length, 74 feet; gross tonnage, 45; cost, $18,000.

Wooden motor launch for E. B. Dave, 6 Beacon street, Boston; length, 71 feet; gross tonnage, 15; cost $12,000.

Wooden motor launch for H. F. Hanson, 50 Congress street, Boston; length, 102 feet; gross tonnage, 70; cost, $26,000.

Wooden auxiliary yawl yacht for J. H. Cromwell, 247 West 125th street, New York; length 80 feet; gross tonnage, 35; cost, $19,000.

Wooden schooner yacht for H. A. Morss, 75 Cornhill, Boston; length 86 ft.; gross tonnage, 40; cost, $25,000.

Steel schooner auxiliary yacht for C. H. Clark, Bullitt Bldg., Philadelphia; length, 119 feet; gross tonnage, 80; cost, $60,000.

C. Hiltebrent, Rondout, N. Y.:

Brick barge of wood for J. H. Love, New York City; length, 95 feet.

Two brick barges of wood, duplicates, for G. W. Washburn, Rondout, N. Y.; length, 112 feet.

Wooden deck scow for Thomas J. Howard, New York; length, 110 feet.

Brick barge of wood for Hutton Co., Rondout, N. Y.; length, 114 feet.

Wooden deck scow for A. O'Boyle, New York; length, 105 feet.

Wooden brick barge for C. P. Hendricks, Rondout, N. Y.; length, 105 feet.

Two wooden deck scows, duplicates, for C. E. Bishop, Rondout, N. Y.; length 105 feet.

Deck scow of wood for J. H. Cullen of New York; length, 110 feet.

Wooden coal barge for J. H. Cullen, New York; length, 112 feet.

Wooden deck scow for Thomas Kiernan, New York; length, 110 feet.

Floating dry dock for C. Hiltebrant, Rondout, 150 feet long.

Oliver Gildersleeve & Sons, Gildersleeve, Conn.:

Coal barges Louie and Charlie, duplicates, for Louis Gildersleeve, 1 Broadway, New York; length 121 feet; gross tonnage, 379; cost $7,009.

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Coal barge Nelson for Louis Gildersleeve, New York; length 105 feet; gross tonnage, 290; cost, $5,500.

Coal barge for Louis Gildersleeve, 1 Broadway, New York; length, 105 feet; gross tonnage, 290; cost $5,500.

Five deck scows, duplicates, for Louis Gildersleeve, 1 Broadway, New York; length, 110 feet; gross tonnage, 285; cost, $7,500.

Saunders Bros., Saunderstown, R. I.:

Steam ferry boat Narragansett, of wood, for Stillman Saunders, Saunderstown, R. I.; length, 118 feet 8 inches; two high pressure engines, 14 x 16, built by New York Steam Safety Co.; 150 horsepower; gross tonnage, 240; cost, $28,000.

Thomas McCosker & Co., Baltimore, Md.:

Tug Prudence for Charles Gring, Philadelphia; length, 97 feet; fore and aft compound engine, 13 x 27 x 22; cost, $25,000.

Racine Boat Mfg. Co., Muskegon, Mich.:

Gasoline tug for S. J. Williams, Norfolk, Va.; length, 35 feet; gasoline engine; 12 horsepower; cost, $1,100.

Ocean cruising launch for Towkay Loke Gew, Singapore; length, 50 feet; gasoline launch; 24 horsepower; cost, $3,300.

Have in contemplation very shortly several orders for large outfits.

Greenport Basin & Construction Co., Greenport, N. Y.:

Wooden auxiliary steamer Comet for Wm. H. Langley; length, 670 feet; Spark gasoline, twentieth century; 30 horsepower; gross tonnage, 42; cost, $10,000.

J. Bishop, Gloucester, Mass.:

Fishing schooner for Sylvanus Smith & Co., Gloucester; length, 120 feet; gross tonnage, 130; cost, $15,000.

Auxiliary schooner yacht for J. F. Brown, Boston; length 90 feet; gasoline engine; 50 horsepower; gross tonnage, 60; cost, $20,000.

Vaughan D. Bacon, Barnstable, Mass.:

Schooner yacht, sail, of wood for George A. Story, 710 Market St., San Francisco; length, 61 feet; 34½ tons displacement; cost $7,000.

John M. Brooks, Harbor View, East Boston, Mass.:

Wooden tow boat Mary Arnold for D. H. Craig, Plymouth, Mass.; length, 81.5 feet; compound engine; one leg boiler; gross tonnage, 80; cost, $20,000.

James M. Bayles & Son, Port Jefferson, L. I., N. Y.:

Motor boat for Christie & Lown, New Orleans, La.; length, 75 feet; 60 horsepower; cost $15,000.

Wm. McKie, 100 Border street, East Boston, Mass.:

Ferryboat Brewster for Boston, Revere Beach & Lynn Railroad of Boston, Mass.; length, 147 feet 10 inches; engines are being built by Quintard Iron Works of New York and boilers by the Atlantic Works, East Boston.

Stern-wheel steamer for Eastern Steamship Co.; length, 178 feet; engines being built by the Atlantic Works of East Boston.

Greene Bros. Co., Seaview avenue, Bridgeport, Conn.:

Wooden oyster boat for J. H. Vreeland Jr., Canarsie, L. I., N. Y.; length, 48 feet; International gas engine; 25 horsepower; gross tonnage, 13; cost, $5,000.

Fulton Iron Works, San Francisco, Cal.:

Wooden steam lumber schooners Mayfair and Thomas L. Wand, duplicates; length 185 ft.; one compound engine, 14 and 32 by 24 in., one Scotch marine boiler; 400 horsepower.

Wooden steam lumber schooner Quinault; length, 190 feet; one compound 15, and 36 inch by 24 inch engine; one Scotch marine boiler, 500 horsepower.

Wooden steam lumber schooner and passenger boat Yosemite; length 215 ft.; one triple-expansion engine 13½, 23 and 40 by 30 in.; two Babcock & Wilcox boilers; 700 horsepower.

Steam lumber schooner and passenger boat Ravalli; length, 190 feet; one triple-expansion engine, 11, 18½ and 32 x 24 inches; one Babcock & Wilcox boiler; 450 horsepower.

J. W. Dickie, San Francisco, Cal.:

Two wooden ferry boats, duplicates, for the San Francisco, Oakland & San Jose Railway, Oakland, Cal.; length, 203 feet; double compound engine, building by Union Iron Works, San Francisco; two water-tube boilers; 2,000 horsepower; gross tonnage, 1,300; cost, $200,000.

J. S. Ellis & Son, Tottenville, N. Y.:

Oyster dredge Columbia for Smith Bros. and Capt. Wedmore, New Haven, Conn.; length, 80 feet; four-cylinder gasoline engine building by Frank Hitchcock of Bridgeport, Conn.; 85 horsepower; gross tonnage, 72; cost, $14,000.

Oyster dredge America for American Oyster Co., New Haven, Conn.; length, 80 feet; four-cylinder gasoline engine building by Frank Hitchcock of Bridgeport, Conn. 85 horsepower; gross tonnage, 72; cost, $14,000.

Gasoline pleasure boat for V. F. Matzen, Brooklyn, N. Y.; length, 45 feet; two cylinder gasoline engine; 25 horsepower; gross tonnage, 12; cost, $3,200.

N. A. Jacobs & Sons, Portland, Me.:

Wooden herring steamer; length, 40 feet; single engine, Stickney make; Roberts boiler; 36 horsepower; net tonnage, 12; cost, $2,000.

Calvin Co., Garden Island, Ont.:

Paddle-wheel steamer for themselves; length 160 feet; lower pressure beam engine; cost, $25,000.

C. E. Bird, Saugatuck, Mich.:

Gasoline yacht for C. E. Bird; length 25 ft; Truscott engine; 6 horsepower; cost $500.

Baltimore Ship Building & Dry Dock Co., Baltimore, Md.:

Tugs George F. Randolph and Hugh L. Band, duplicates, for the Baltimore & Ohio Railroad; length, 118 feet; compound engine 20 and 40 by 28 inches; 400 horsepower; gross tonnage, 202; cost, $80,000.

Tug Ohio for Baltimore & Ohio Railroad; length, 120 feet; 22 by 28 single engine; 400 horsepower; gross tonnage, 220; cost, $80,000.

Stanley C. Vansant, Atlantic City, N. J.:—

Sloop yacht for Capt. John Dutch, Atlantic City, N. J.; length 60 feet; gross tonnage, 20; cost, $5,000.

Sloop yacht for Capt. George Gale, Atlantic City, N. J.; length, 60 feet; gross tonnage, 20; cost, $5,000.

Cruising launch for Col. Thomas Potter, Atlantic City, N. J.; length, 45 feet; two Standard twin-screw engines; 30 horsepower; cost, $5,500; gross tonnage, 20.

Auxiliary schooner smack for Albert Anderson, Holly Beach, N. J.; length 50 feet; Lathrop engine; 15 horsepower; gross tonnage, 18; cost, $4,000.

Auxiliary schooner smack for A. Carlson, Holly Beach, N. J.; length 50 feet; Lathrop engine; 15 horsepower; gross tonnage 18; cost $4,000.

Auxiliary sloop for Oscar Elmquist, Holly Beach, N. J.; length, 45 feet; Lathrop engine; 15 horsepower; gross tonnage, 15; cost, $3,000.

H. D. Bendixsen Ship Building Co., Eureka, Humboldt Co., Cal.:

Steam schooner Ravalli for the Hammond Lumber Co., 404 Merchants Exchange, San Francisco; length, 205 feet; engine being installed by Fulton Iron Works, Harbor View, San Francisco; gross tonnage, 975; cost, $100,000.

Steam schooner Yosemite for Charles R. McCormick & Co., 303 California street, San Francisco; length, 215 feet; engine building by Fulton Iron Works, Harbor View, San Francisco; gross tonnage, 1,025; cost $110,000.

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Madison Marine Railway & Ship Yard, Madison, Ind.:

Two sand barges, duplicate, for H. L. Block, St. Louis; length, 130 feet; gross tonnage, 287.4; cost $7,000.

John Ryan, Whitehall, N. Y.:

Three canal boats for use in state canals and Hudson river built to carry from 325 to 400 tons, for New York parties; length, 99 feet; gross tonnage, 98 feet; cost, $3,000.

Dubuque Boat & Engine Co., Dubuque, Iowa.:

Sidewheeler for Mississippi, Louisiana Transfer Co., Vicksburg, Miss.; length, 305 ft; two high pressure engines, 26 x 120 inches; two batteries of Bonson boilers, 72 inches diameter by 18 feet long of two each; 800 horsepower; gross tonnage, 1,200.

Sawyer Bros., Milbridge, Me:

Merchant schooner for D. J. and E. M. Sawyer; length, 162 feet; gross tonnage, 260; cost, $25,000.

Merchant schooner for the market; length, 215 feet; gross tonnage, 575; cost, $40,000.

Schooner for the market 130 feet long.

Lake Torpedo Boat Co., Bridgeport, Conn.:

Steel gasoline submarine torpedo boat for themselves; length, 83 feet; gasoline engines and electric motors; 400 horsepower; gross tonnage, 140; cost, $275,000.

Kelley-Spear Co., Bath, Me.:

Auxiliary 4 M. C. B. schooner for the Benvenue Granite Co., New York; length, 175 feet; compound engine; Roberts water-tube boiler; 200 horsepower; gross tonnage, 737; cost, $60,000.

West Oakland Ship Yard of Southern Pacific Co., West Oakland, Cal.:

Doing repair work now on one ferry steamer. Have one new car ferry and one new passenger ferry in contemplation.

E. S. Crosby, Bath, Me.:

Four-masted sailing schooner for the Crosby Navigation Co.; length, about 240 feet; donkey engine for hoisting purposes; gross tonnage, 1,500; cost, $80,000.

Portland Ship Building Co., Portland, Me.:

Wooden steam tug Orion for the Boston Tow Boat Co., Boston, Mass.; length, 104 feet; compound engine; Scotch boiler; 450 horsepower; gross tonnage, 150; cost, $38,000.

F. S. Bowker & Son, Phippsburg, Me.:

Four-masted wooden schooner for the market; length, 191 feet; gross tonnage, 633; cost, $42,000.

M. J. Godfrey, Clinton, Iowa:

Two light draught wooden sternwheel river boats, duplicates, for the Grand Rapids Lake Michigan Transportation Co. at Grand Rapids, Mich; length, 150 feet; lever high pressure engine; 500 horsepower; gross tonnage, 219; cost, $20,000.

Stern-wheel pleasure boat for Lafayette Lamb, 115 feet long; machinery furnished by the Clinton Novelty Iron Works.

Wanderer II, 130 feet long, lever high pressure engine building by the Clinton Novelty Iron Works, Clinton, Iowa; 500 horse power; gross tonnage, 126; cost, $16,000.

Hitchings & Joyce, Hoquiam, Wash·:

Wooden lumber steamer for trade on Pacific coast for J. O. Davenport & Co., 123 California street, San Francisco; length, 170 feet; fore and aft compound engine, 14 x 32 x 24 inches; Scotch boiler, 10 feet 9 inches by 10 feet 6 inches; 400 horsepower; gross tonnage, 600; cost of hull, $30,000. This boat is an oil burner and is exclusively for the lumber trade; will carry 550 M. feet of lumber. Engines and Machinery outfit is being built by the United Engineering Works of San Francisco.

Read Bros., Fall River, Mass.:

Wooden auxiliary yawl for A. Homer Skinner, Fall River, Mass.; length, 57 feet; three cylinder naphtha engine; 16 horsepower; gross tonnage, 12; cost, $6,000.

Wooden launch for Read Bros.; length, 30 feet; naphtha engine; 10 horsepower; cost, $2,000.

Cobb, Butler & Co., Rockland, Me.:

Fourmasted wooden schooner for Cobb, Butler & Co.; length, 200 feet; gross tonnage, 1,000; cost, $62,000.

Four-masted wooden schooner for Garrett, Schenck; length, 240 feet; gross tonnage, 2,000; cost, $120,000.

Two covered lighters, duplicates, for the Rockland-Rockport Lumber Co.; length, 95 feet; gross tonnage, 115 feet; cost, $12,000.

Southern Ship Building Co., Jacksonville, Fla.:

Four-masted wooden schooner for Jacksonville parties (H. W. Cook, Philadelphia, managing owner); length, 188 feet; cost, $45,000.

Sixteen wooden lighters, duplicates, for the Florida East Coast Railway, Key West extension, length, 100 feet; cost, $3,000.

Nine wooden lighters, duplicates, for the Florida East Coast Railway, Key West extension; length, 100 feet; cost, $4,000.

Three wooden lighters, duplicates, for the Florida East Coast Railway, Key West extension; length, 70 feet; cost, $3,900.

Irving W. Adams, Boothbay, Me.:

Wooden fishing schooner for A. E. Sennett, Portland, Me.; length, 60 feet; gross tonnage, 30; cost, $3,500.

Wooden schooner Pilot boat for W. L. Johnson, Portland, Me.; length, 60 feet; gross tonnage, 30; cost, $3,500.

Wooden water boat for N. E. Petticgsono, New London, Conn.; length, 40 feet; Standard gasoline engine; 18 horsepower; gross tonnage, 15; cost, $2,800.

Lumley & Dodson, 191 Water St., Norfolk, Va.:

Two 61-foot fishing boats designed and equipped especially for the business; hulls are being built by E. James Tull, Pocomoke, Va. This company makes a specialty of designing and equipping gasoline motor boats.

Springfield Boiler & Manufacturing Co., 308 East Grand avenue, Springfield, Ill.:

Self-propelling, side-wheel dredge B. M. Harrod for the Mississippi River Commission, U. S. A. Government; 36 inch centrifugal pump driven at 1,500 horsepower of high speed engines.

Diamond Jo Line, Dubuque, Iowa:

Repairing passenger and freight steamer Sidney for themselves.

Repairing steamer Ben Hershey, raft boat, for the Iowa & Minnesota Navigation Co., Minneapolis, Minn.

Repairing steamer Everett; raft boat, for the Iowa & Minnesota Navigation Co.

Repairing steamer C. W. Cowles, raft boat, for Capt. George Winans, Waukesha, Wis.

Quintard Iron Works Co., foot of Twelfth street, East River, New York city:

Ferry boat for Boston Harbor—cylinder 30 in. diameter by 8-ft. stroke. Boiler will be furnished by the Atlantic Works.

Three steamers, duplicates, for the New England Navigation Co.; length, 396 ft.; 7,000 H. P. Details of machinery have not been entirely completed. Contracts for the hulls of these steamers have been sublet to the Wm. Cramp & Sons Co., of Philadelphia.

Farrar & Trofts, 54-56 Perry St., Buffalo, N. Y.:

Three Scotch marine boilers, 12 feet diameter by 11 feet 6 inches long, each having three Morrison suspension furnaces, for the steamer Mohawk, of the Western Transit Co.

Three Scotch marine boilers, 14 feet diameter by 13 feet long, each having three Morrison suspension furnaces, two for the steamer Northern Queen and one for the steamer Northern Light, of the Mutual Transit Co.

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G. G. Deering, 226 Washington St., Bath, Me.:

Four-masted schooner, to be managed by the G. G. Deering Co.

W. W. Howell & Co., 296-302 Upper Water St., Halifax, N. S.:

One vertical tandem compound marine condensing engine, 13 in. and 26 in. by 18 in. stroke, and one Scotch marine boiler, 9 ft. diameter, 9 ft. long, with two furnaces 36 in. diameter, working pressure of 130 lbs. square in., for steamer building by Joseph McGill, Shelbourne, N. S., for Wm. Leslie & Co., Grindstone, Magdalene Islands, N. S., Canada.

John E. Mar & Son, West Haven, Conn.:

Scow for Colonial Lighterage Co., New York City; length, 92 feet; only hoisting engines; cost, $6,500.

Scow for New York; length, 90 feet; cost, $6,800.

Scow for Van Wye Lighterage Co.; length, 90 feet; cost, $6,500.

Scow barge for Van Wye Lighterage Co.; length, 95 feet; cost, $6,800.

Launch for R. W. Higbie of New York; length, 31 ft.; two cylinder, four cycle gasoline engine; 14 H. P.; cost, $1,600.

Launch for C. F. Perry, 66 Broadway, New York; length, 26 feet; two cylinder, four cycle gasoline engine; 7½ horsepower; cost, $900.

Launch for the market; length, 25 feet; two cylinder, four cycle gasoline engine; 7 horsepower; cost, $800.

Wolverine Gas Engine Co., Grand Rapids, Mich.:

Gasoline tug launch Ralampago for Montevideo, S. A.; length, 45 feet; three cylinder, four cycle Wolverine engine; 18 horsepower; cost, $3,400.

Gasoline tug launch Coscopa for Coatzacoalcos, Mexico; length, 40 feet; three cylinder, four cycle Wolverine engine; 13 horsepower; cost, $2,700.

Ferry-boat for the Macatawa Park Association; length, 40 feet; three cylinder, four cycle Wolverine engine; 27 horsepower; cost, $2,300.

Stern-wheel river boat F. C. Adams for the Macatawa Park Association; length, 27 feet; single cylinder, four cycle Wolverine engine; 3½ horsepower; cost, $800.

Pleasure launch Wolverine, for M. Denison, Manitou; length, 22 feet; double cylinder, two cycle Wolverine engine; 6 horsepower; cost, $750.

Gasoline tug launch for Porto Barios, Guatemala; length, 55 feet; three cylinder, four cycle Wolverine engine; 36 horsepower; cost, $3,900.

United Engineering Co., 254-256 Spear St., San Francisco, Cal.

Engine and machinery for steamer Johann Poulsen, building for Swett & Loop, San Francisco, Cal.; 13, 22 and 36 inch by 24 inch, triple expansion engine; one Heine water-tube boiler; 500 horsepower; hull built by C. White, Aberdeen, Wash.

Engine and machinery for steamer Coaster building for Charles H. Higgins & Co., San Francisco, Cal.; one 14 and 32 inch by 24 inch compound engine; one Scotch marine boiler; 400 horsepower; hull built by Mr. Lindstrom, Grays' Harbor, Wash.

Engine and machinery for steamer Tiverton, building for J. O. Davenport & Co., San Francisco, Cal.; one 14 and 32 inch by 24 inch compound engine; one Scotch marine boiler; 400 horsepower; hull built by Hoquiam Ship Yard, Wash.

One steel water boat for the Wilmington Transportation Co., Los Angeles, Cal.; length, 140 feet; compound engines; 300 horsepower.

Main Street Iron Works, San Francisco, Cal.:

Marine outfit complete for freight steamer building for Messrs. Sudden & Christensen, of San Francisco, consisting of Main engine, compound, 400 horsepower, 14 inch diameter horsepower cylinder, 32 in. diameter L. P. cylinder, 24 inch stroke; one Scotch marine boiler, 11 feet diameter by 10 feet 9 inches long, with two corrugated furnaces arranged for oil fuel; also cargo hoists, anchor windlass, capstan, etc., for same complete.

Arthur D. Story, Essex, Mass.:

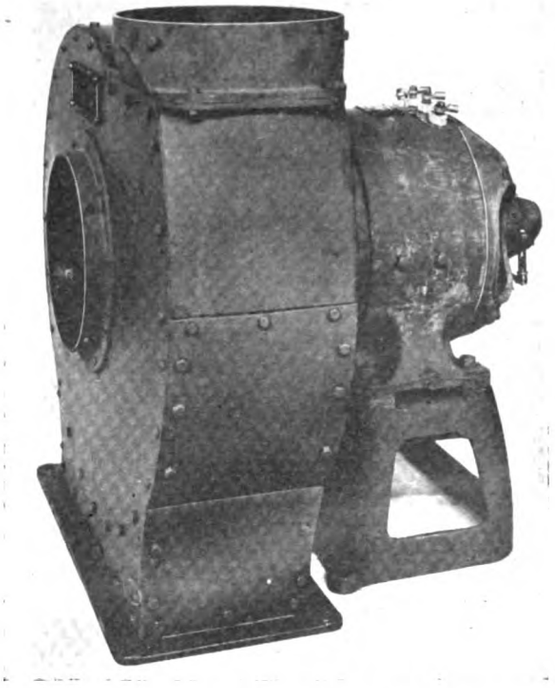
Schooner Estelle, wood, for Capt. T. C. Vanderpool, Island of Saba, West Indies; length, 112 feet; gross tonnage, 136; cost, $14,000.

Schooner Athlete for John Pen & Son, Gloucester, Mass., length, 112 feet; gross tonnage, 135; cost, $14,000.

Wooden schooner for H. Parkhurst & Co., Gloucester, Mass.; length, 118 feet; gross tonnage, 135.

VENTILATION ON SHIPBOARD.

From the nature of ship construction, the question of ventilation is of the greatest importance in marine design. Not only is a ship difficult to ventilate as a whole, but its subdivision into compartments by watertight bulkheads has greatly complicated the problem. Owing to this isolated construction, there has arisen a need for artificial ventilating apparatus which shall keep these closed portions of a ship supplied with



DIRECT CONNECTED TO 40 IN S. P. EXHAUSTER.

fresh air and remove the foul products of combustion. Heretofore, stream driven systems of fans have been installed to force fresh oxygen into the ship and draw out the vitiated air. Within the past few years, however, the advantages of electricity for this work have led to its general adoption in ventilating systems, particularly in the case of sectional ventilation. Not only does the flexibility of this system render it particularly adaptable, but it is also free from heat, noise and dirt.

In this modern solution of the ventilating problem, the adoption of electricity in this and other departments of marine work has accomplished many results heretofore unattainable. In general the principal advantages of electricity are its economy, convenience and absolute safety, but it also provides for valuable appliances, impossible with older methods. A modern electric plant occupying remarkably small space may furnish power for ship illumination, electric searchlights,

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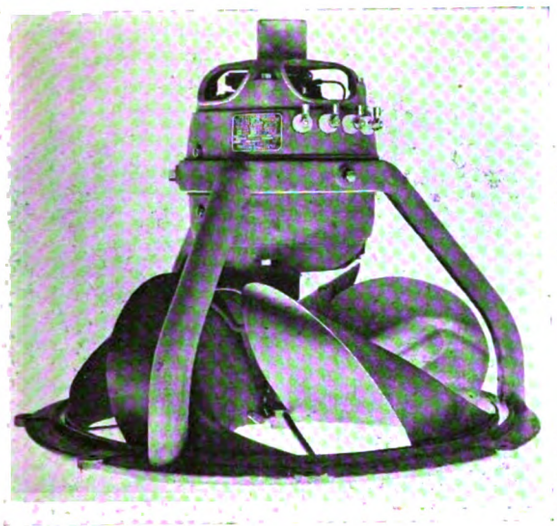
signals, running lights and hoists. In the case of blower motors for ventilating purposes the flexibility of the electric systems shows to particular advantage.

As mentioned before, in the larger vessels, it is now customary to install a separate ventilating system in each section



DIRECT-CONNECTED TO 36 IN. DANDSON EXHAUSTER

of the ship. In this method the neccessary supply and exhaust fans are electrically driven. Not only does this scheme of drive do away with large openings in bulkheads for steam pipe lines for engine fans, but it eliminates the heat, noise and dirt of such a motive power. The fact that there is little heat radiated by an electric motor is one of the most important factors in its use, as the high temperature of a steam engine makes its application to this work prohibitive in many cases. An electric motor is practically noiseless and, as it has but one moving element, the wear is reduced to that of the bearings alone, so that there is no liability of noise caused by worn parts. There is, moreover, no third bearing to get out of alignment, as the fan is hung on the shaft on the outer side of the motor bearing, making a compact and self contained machine. Having no exposed oiled parts, the electric motor is also very clean, and this feature alone would recommend it as a motive power for fans. Aside from the general statement of flexibility with regard to its source of power, the readiness with which an electric motor may be fastened to decks and bulkheads makes it the most convenient power to install in ventilating systems. The economy of space implied in the last statement is a most important consideration on shipboard, where every foot counts, partcularly on our modern warships.

Not all motors will meet the requirements as outlined, and special forms have been designed, which fulfill the most exact conditions.

In all United States naval work, the limit of temperature

BLOWER SETS DIRECT-CONNECTED TO CONVERTIBLE TYPE MONOGRAM EXHAUSTERS.

rise is fixed lower than for ordinary commercial practice; this being true for all classes of electric apparatus, including generators and motors. As yet, direct current is practically the only form in which electricity is used on board ship. The motors are, therefore, of the direct current type, compact and self contained. Due to the fact that the climate in which a vessel may lie, differs greatly in widely scattered ports, a 20 per cent speed variation is frequently allowed on the motors, so that the amount of air supplied by the fans may be changed to suit climatic conditions. This definement is to be found in naval work, but would probably not be attempted aboard commercial vessels. In the fan equipments, as illustrated, made by the General Electric Co. of Schenectady, N. Y. other features are embodied in addition to those mentioned. The bearings are not only self oiling, but non-spillable by a special device suiting them especially for marine work. The smaller metallic parts are made of non-corrosive material, an essential feature in all machines for marine service, which are subjected to moisture. A special point of the cast shell type, as shown, which deserves more than passing mention, is the fact that it is easily convertible from right to left hand fans. Looking at the discharge opening of a fan, it is designated as rght or left hand respectively, according to the side on which the motor is placed. These fans have end plates so arranged that the motor may be fitted to either side.

A further adjustment of the end plates also permits the discharge end of the fan to be tilted into four or eight positions through 360 degrees. This simplifies the design of ventilating systems, inasmuch as the fan need not necessarily be made specially for different installations, but may be fitted to almost any position after the other work, piping, etc. is completed.

The application of electricity to marine work has been most advanced in the United States navy. About the first ships to install electrical apparatus for ventilating purposes, were the Kearsage and Kentucky in 1900, and since then none of the large men-of-war has used any other power for this purpose. The application of electricity on commercial ships has not been so general, but recent installations show that here as in other fields, it is steadily gaining recognition as an ideal power. The steamship Minnesota, of the Great Northern Steamship Co's. fleet was installed thirty-eight electric motor driven ventilating sets of various types, ranging in size from one to eleven horse-power, and aggregating 184 H. P. as the total energy used for this purpose. As electricity is the most convenient and adaptable power for this work, it may soon be expected to be used most extensively in commercial marine, as well as naval practice.

The Twin City Rapid Transit Co., Minneapolis, Minn., is building nine fast passenger steamers to operate on Lake Minnetonka, in connection with their railway service. Six of these boats will be of the single screw propeller type driven by high speed triple expansion condensing engines, supplied with steam by Roberts safety water-tube boilers. The other three will be side-wheel ferry steamers. The Marine Iron Works, Chicago, Ill., is doing the work.

The Newport News Ship Building & Dry Dock Co. has received an order from the old Dominion Line to lengthen by 45 ft. the following vessels of its fleet: Hamilton, Jefferson, Jamestown, Princess Ann and Monroe. In order to do this each vessel will have to be cut in half and the additional length inserted amidships. The Hamilton will be the first to be lengthened.

The Sharpley Marine Railways Co., Greenbackville, Va., report that they are making extensive improvements in their dock. They are at present building a 30-ft. launch to be equipped with a 10 H. P. gas engine, and are putting the ceiling in a 600-ton vessel.

The Great Lakes Engineering Works, Detroit, has sent out a New Year's greeting which is more than ordinarily artistic.

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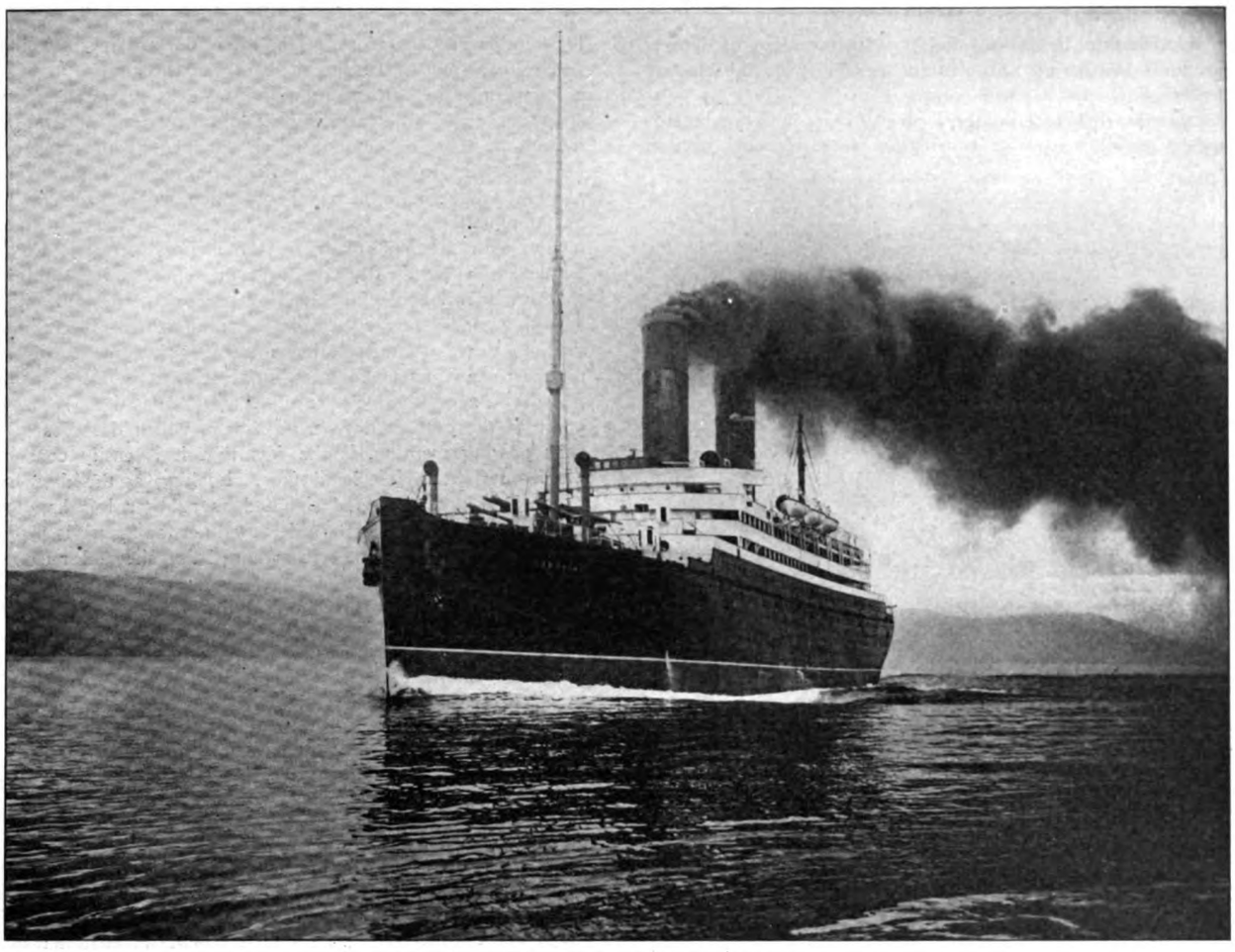

CUNARD TURBINE LINER CARMANIA.

Cunard Turbine Liner Carmania.

A visit to the Carmania while lying at the Cunard pier in New York during the week of Dec. 11, was especially illuminating. She is the fastest leviathan afloat. While a few other ships exceed her in size, none of her tonnage equals her in speed. Probably no ship afloat is her equal in general excellence of appointment. The Carmania is more like a floating hotel than a steamer. There is a total absence of the impression of contracted space that is so generally received aboard ship. Everything about the Carmania is spacious. Comfort is the keynote of this great ship and it is literally true that the third class accommodations aboard the Carmania are better than the second class were ten years ago or even the first class in the early days of the steamers. The third class accommodations are all located well above the water line with an abundance of deck space, ample lavatory accommodations, and best of all, individual rooms.

The Carmania is the first turbine steamer to visit the United States. The turbine installation on this steamship is so large as to fairly approximate the installation that must be placed in the Cunard's express liners now under contract of construction with the British government, that is to say, they are so large that accurate data can be deduced from their performance to determine the installations necessary in the larger steamers.

The Carmania made twenty knots with such ease on her trial and conducted herself so admirably on her maiden trip that expert engineers express no doubt whatever that the two great turbine steamers now building can readily make 25 knots and even exceed it. The Carmania came over in very foul weather, being continuously in one of the worst storms of the season, and yet experienced no difficulty, the turbines working with absolute precision. At no time was there any hitch whatever, nor was there any perceptible vibration.

For the description and illustrations of this magnificent steamer the MARINE REVIEW is indebted to *Engineering of London,* and to Mr. L. Sandford of the New York office of the Cunard Steamship Co.

The extreme simplicity of the turbine renders it difficult to describe. In construction it may be said to resemble the two halves of a walnut shell, or perhaps more exactly a hollow cylinder split longitudinally. Within the cylinder is a drum fixed upon the shaft. The drum revolves; the cylinder remains stationary. Steam enters at one end of the cylinder and escapes at the other. This is all. There are no pistons, cams, eccentrics, connecting rods, or any of the complicated devices required on reciprocating engines to convert this form of motion into rotary. In the turbine, rotary motion is imparted direct to the shaft by the pressure of the steam. The method by which this is done is wonderfully ingenious, yet simple in its operation. There are alternating rows of blades or vanes between the exterior face of the drum and the interior surface of the cylinder. The first row of blades is fixed to the circumference of the drum, the ends projecting outward and their faces placed diagonal to the axis of the shaft, which is the direction of the flow of

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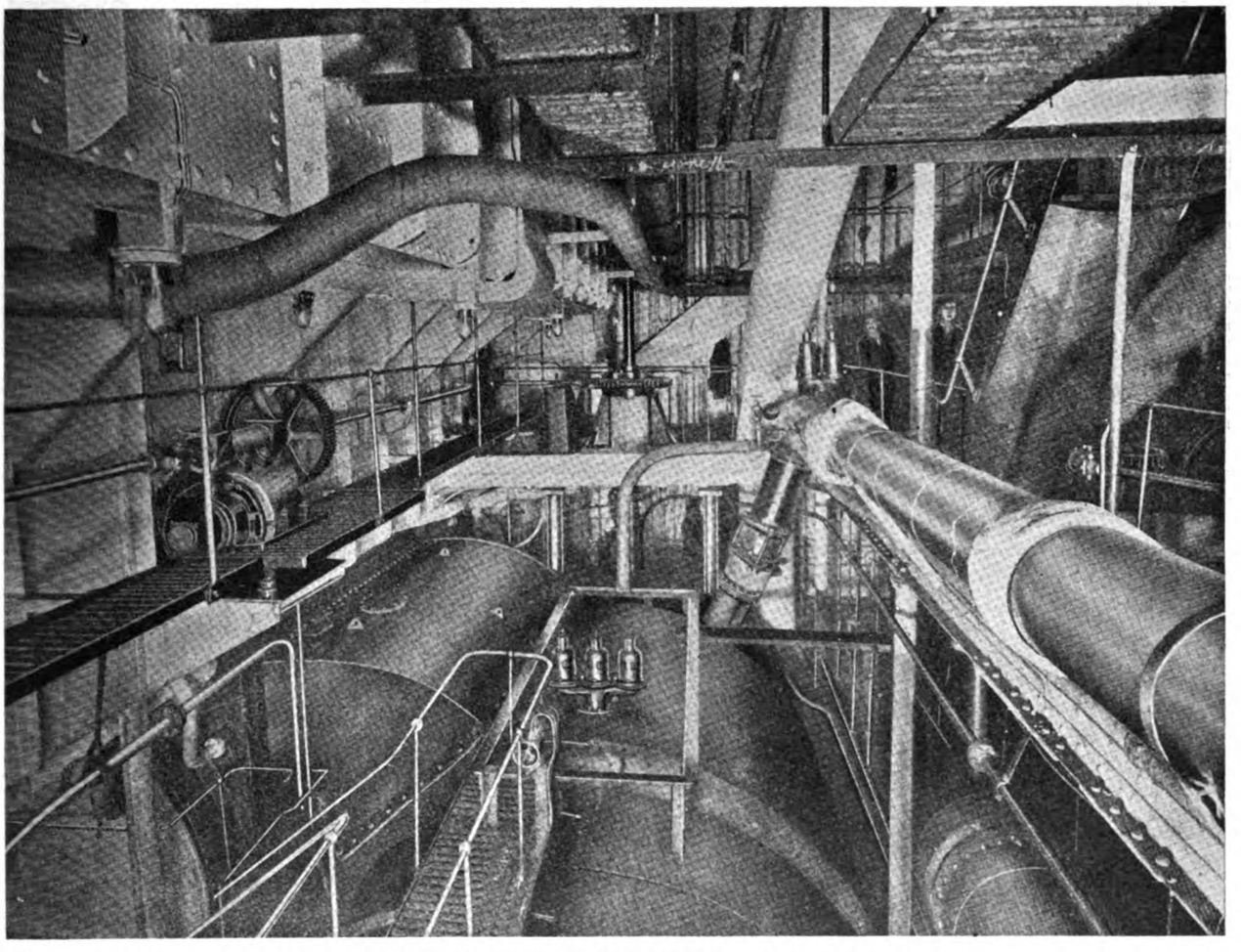
steam as it first enters the cylinder. Close up to this first row of blades is another, but these are fixed to the inner surface of the cylinder and are set at a reverse angle to the first. Their office is merely to turn back the flow of steam, which has been deflected from its direct course by contact with the first row of blades on the drum, to its original direction. It then impinges on the second row of blades attached to the drum, is once more restored to its direct course by the second row of blades on the cylinder, and thus passes through the cylinder from one end to the other, at each change of direction exerting its full expansive force. As the cylinder is fixed and immovable, the force of the steam takes effect entirely upon the drum, which is caused to revolve with great rapidity, carrying this is an additional advantage of the turbine over the reciprocating type.

The Carmania and her sister Caronia (fitted with reciprocating engines) are among the seven or eight largest of the world's ships, but no vessel of greater size has attained the same high speed; while the internal arrangements are unexcelled for effectiveness and comfort. The leading dimensions of the ship are tabulated below:—

Length between perpendiculars	650 ft.
Length, over all	672 ft. 6 in.
Breadth, molded	72 ft.
Depth, molded	52 ft.
Depth from keel to roof of navigating bridge	90 "
Depth from keel to top of funnels	144 "
Depth from keel to top of masts	205 "



VIEW IN CARMANIA'S ENGINE ROOM FROM UPPER GALLERY, LOOKING AFT.

with it the shaft to which it is attached. The propeller is fixed upon the after end of the shaft, and revolves with it in the water. The turbine may be said to consist of only two parts—the stationary cylinder and the rotating drum with its shaft and propeller. No greater simplicity can be imagined in a source of power. There are 1,250,000 blades in the turbines of the Carmania.

There is no friction in the turbine, no packing rings or stuffing boxes to obviate leakage of steam, and no internal lubrication is required in the cylinder. Compounding the turbine engine is easily accomplished by making more cylinders and drums or of larger diameter, with larger blades more widely separated. From the high to intermediate and low pressure cylinders—as with the ordinary engine—the steam passes to the condenser and thence returns to the boiler in the form of feed water. Being free from cylinder oil it does not foul the condensers, and

Gross register tonnage	19,524 tons
Collective length of decks	3,900 ft.
First-class passengers	300
Second-class passengers	326
Third-class passengers	1,000
Steerage passengers	1,000
Officers, engineers, and crew	710
Total	3,336
Draught in working condition	33 ft. 3¼ in.
Displacement at this draught	30,918 tons

In order to obtain the speed of 19 knots, which was considerably exceeded in both ships, as will be shown later, a coefficient of fineness under 0.7 was adopted, notwithstanding the large carrying capacity. But even in the 25-knot ships the coefficient will not be so low as is the case with some modern cruisers, where the necessity for adopting a moderate length for the purpose of minimizing the weight

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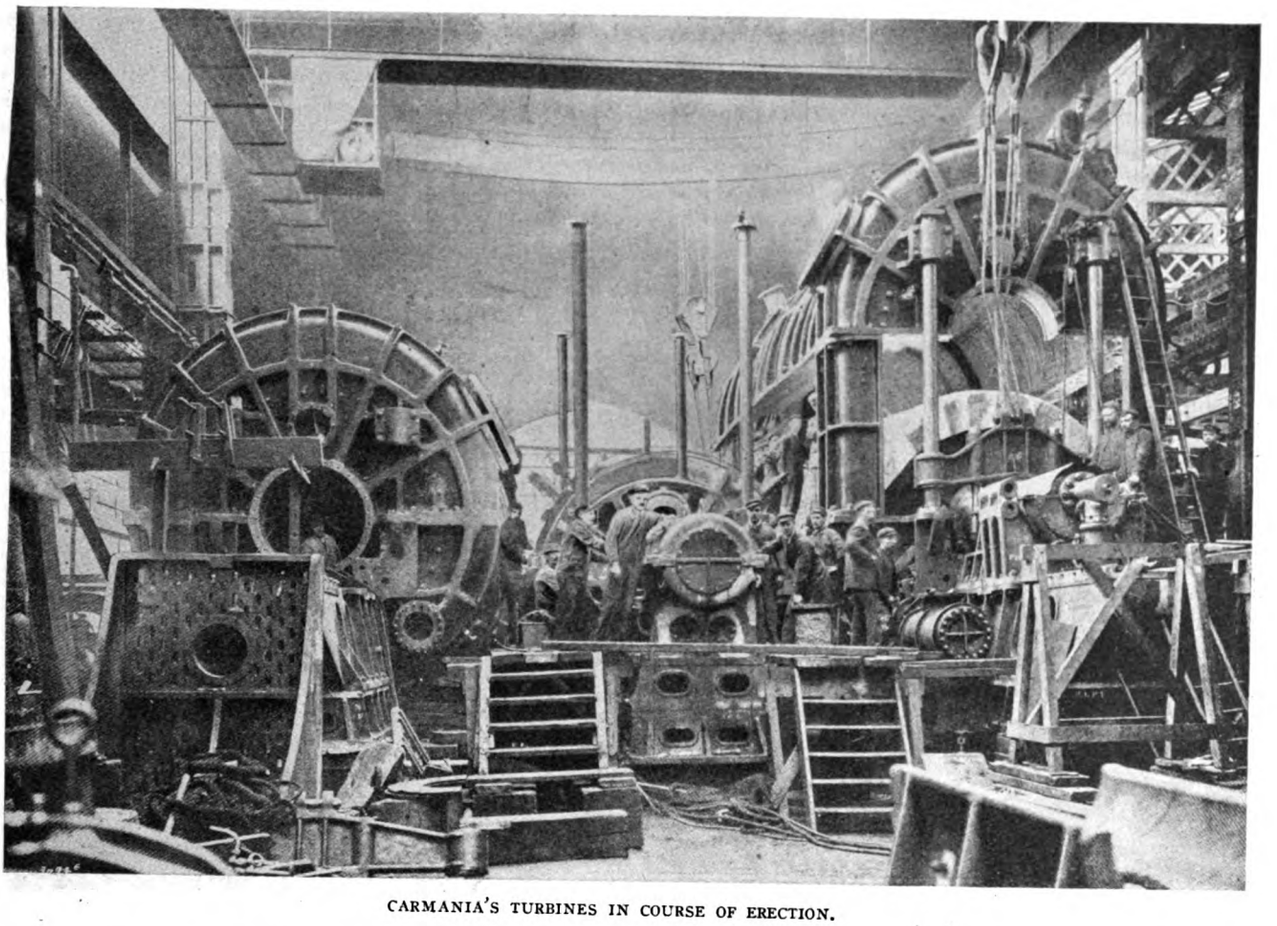
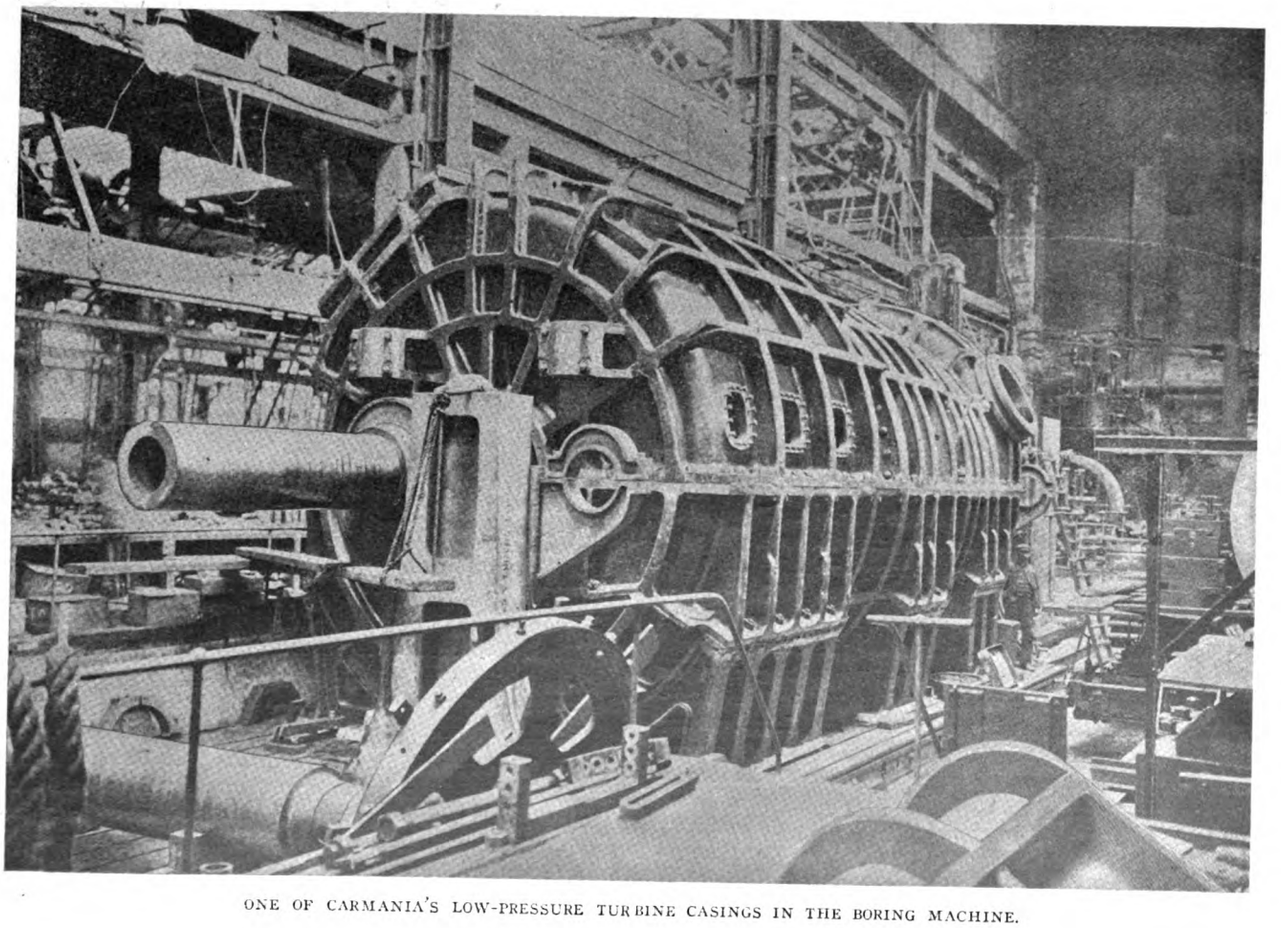


CARMANIA'S TURBINES IN COURSE OF ERECTION.



ONE OF CARMANIA'S LOW-PRESSURE TURBINE CASINGS IN THE BORING MACHINE.

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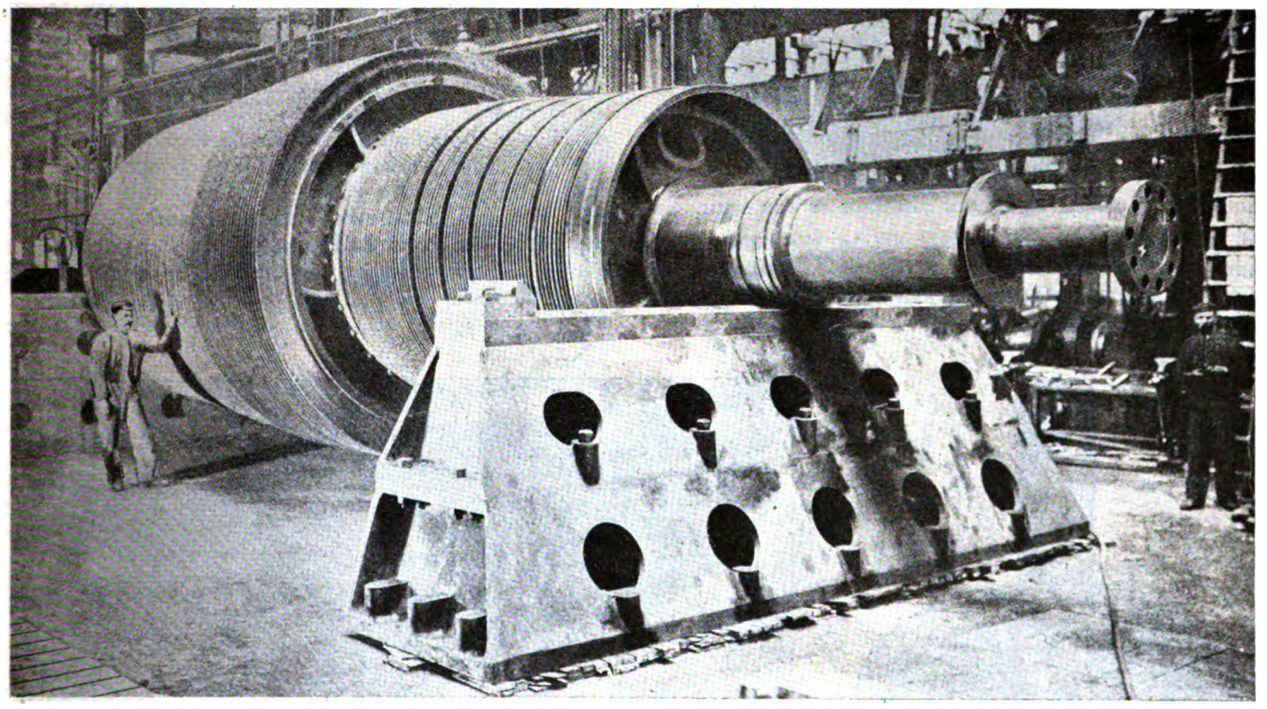
of heavy armor, and also for reducing the target presented to the enemy, involves a fineness in some cases of not much over 0.5.

DESCRIPTION OF THE HULL.

The Carmania was begun on Feb. 29, 1904, and was launched on Feb. 21, 1905, being then in an unusually advanced state of construction. In the construction of the vessel 12,000 tons of steel and 1,800,000 rivets were required. Many of the plates were 1⅛ in. thick, 32 ft. long, and 5½ ft. in width. In many cases the plates have quadruple riveting; the sheer-strake is quintuple riveted, 1⅛ in. rivets being used.

In connection with the flat keel plate forming what may be termed the bottom boom of the girder, a departure has been made; it is formed without outside straps, and consequently a flush surface is obtained for the entire length of the vessel. This is a great convenience in connection with the dry-docking of the ship. The flat keel is built up with three thicknesses of plating about 55 in. broad, and with a combined thickness of 3 in. The internal vertical keelplate—the web of the girder—is 5 ft. deep and over an inch in thickness, and is secured by heavy angles to the flat keel-plates and to the inner bottom floor-plates. This construction is continued for the whole length of the ship, although the keel-plating is reduced in thickness at the forward and after ends. The bottom framing of the ship is 70 ft. wide at the central part, tapering towards the bow and stern to take the form of the ship; this structure is built up of floor-plates at right angles to the center girders, of a depth of 5 ft., and extending nearly to the turn of the bilge. Fitted intercostally with these there are on each side of the center girder three longitudinals, secured by angles, and forming, with the plating, the double-bottom structure of the ship. This double-bottom is used for carrying water ballast, and to give access to all parts and, incidentally, to lighten the structure, holes have been formed in both the floor-plates and intercostal girders. The fourth girder from the center line is continuous, and from it there extend tail-plates. These terminate with the longitudinal known as the margin-plate, which also is continuous. Between the fourth continuous girder and the margin-plate there is a further intercostal, which very materially strengthens the ship at the turn of the bilge, and assists to take up the stresses due to the bilge keels.

The side framing above the double bottom is of channel section, 9 in. deep for the greater part of the length of the vessel amidships. The spacing of the framing in the center part of the ship is 32 in., and at the bow and stern, where heavy angles take the place of the channels, it is diminished by steps to 27 in. These angles have reverse angle-bars near the edge of the transverse flange. Each fifth frame in the machinery and boiler compartments, and each sixth frame forward and aft, are of web section, built up of ½ in. plates 30 in. deep, with strong angles on the inner edge and double-angle connections to the shell of the ship. The web frames extend vertically to the main deck. The framing at the bow of the ship, where the structure is specially strengthened by girders and stronger beams, in order to take the thumping or panting stresses. The web frames were built in the framing-yard, and were fitted there, with all connections hydraulic-riveted, and subsequently moved to the building berth. The frame angles to the shell are joggled in the way of the double bottom; but outside the double bottom the shell is worked with the usual raised and sunken strakes, having slips fitted between the raised strakes and the frames.



BALANCING ONE OF CARMANIA'S LOW-PRESSURE AND ASTERN MOTORS.

The main framing thus described extends to the bridge-deck amidships, and to the weather-deck at the ends of the ship. The decks above this, forming promenades for the passengers, with central deck-houses for cabins and saloons, are supported by heavy angle standards, 6 in. deep and 8 ft. apart.

The shell plating is for the most part 1 in. in thickness, and generally of 5 ft. width of strake. It is lap-butted, and almost entirely quadruple-riveted. The four topside strakes of the plating of the hull are double-strapped and quadruple-riveted. Within the range of

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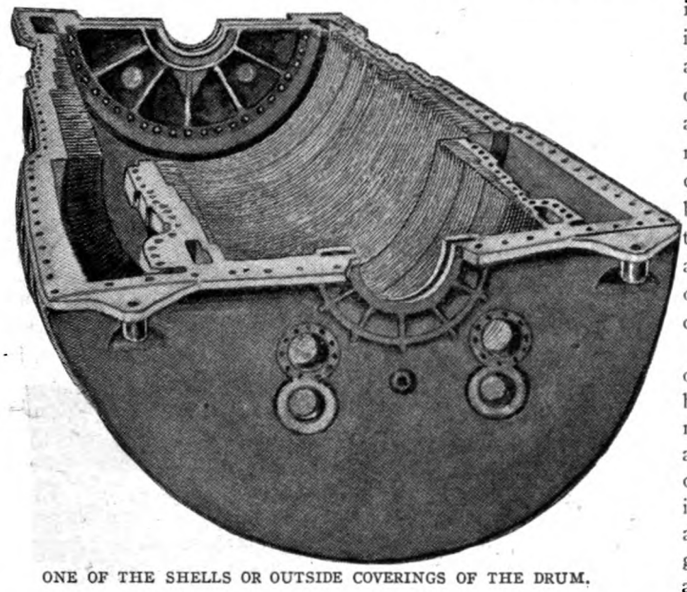
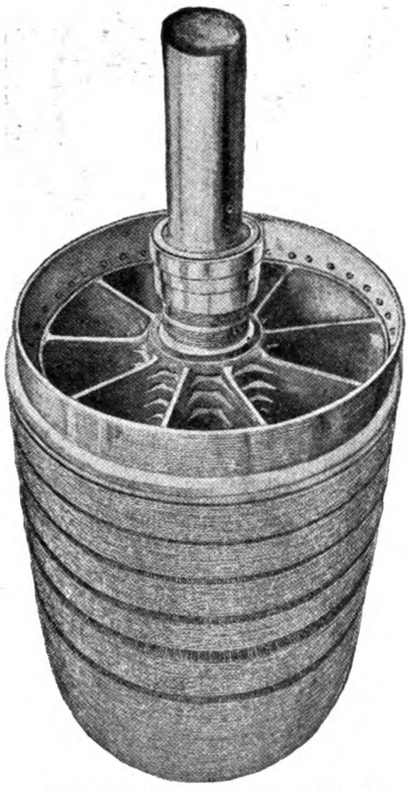
the double bottom the shell plating is also double-strapped, treble-riveted inside, and double-riveted outside, and the butts of the keel-plates are treble-riveted. Wherever possible hydraulic riveting was resorted to,



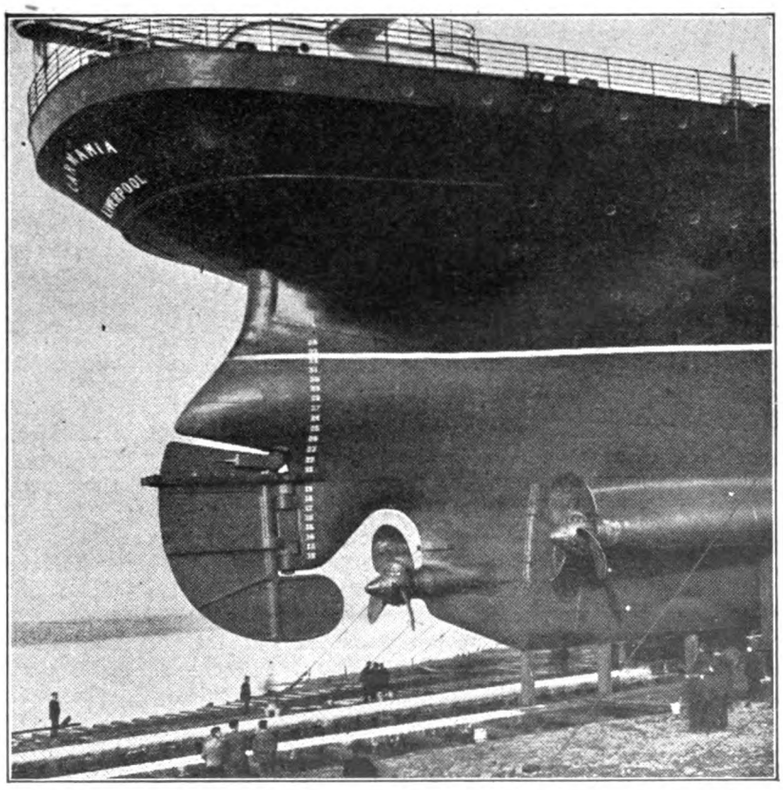
ONE OF THE SHELLS OR OUTSIDE COVERINGS OF THE DRUM.

and even before the rivets were put in, the plates and angles were forced and held together by hydraulic power, so that the temporary bolts and nuts would bring the surfaces as closely together as possible before riveting. In this way there was absolutely no possibility of yielding when the rivets were put in. The work done by hydraulic power includes the center girder, keel-plate, garboard strake, the center strake of the inner bottom, the intercostal girders, the end frames to the reverse angles of beam-knee brackets, the bridge-deck sheer strake, the shelter-deck stringer angles, and the side-stringers between the web-frames. The rivets in the shell and tank top-plating vary from ¾ in. to 1⅛ in. in diameter, spaced on an average 4 to 5 diameters apart. In the bulkheads the sizes generally are ¾ in. in diameter, spaced 4 to 5 diameters apart; the deck rivets are ¾ in., spaced generally 4 to 5 diameters apart. The riveting-machine was, as is shown in several illustrations, carried on a beam, having on its other end a counter-balancing weight. This beam was supported in the center upon a lattice-built column running on wheels, or on a small truck running on the railway track which was laid on each successive deck as soon as there were beams to carry it.

Two types of riveters have been used; the hinged riveter of the scissors type, and the bow riveter, both supplied by Sir William Arrol and Co., Ltd., Glasgow. The scissors riveters ranged in gap from 60 in. to 75 in. The hobby-arms are cast in Siemens-Martin steel, and truly machined on large side-bearing surfaces at the hinge; the hinge-pin is of best forged steel; the dies are of hard cast steel, and the cylinder-cover is of mild steel; the piston is of gun-metal, and the working valve is of the piston type, and is in gun-metal. A relief arrangement is provided, so that in the event of the arms being closed when the dies are not in place, no damage is done in the cylinder-head, the water escaping. Two hangers are provided, so that the dies may be worked in a horizontal or vertical position; by moving the point of suspension to the right or left along the hanger, the dies will lie at a corresponding angle. The machine is especially suitable for riveting in corners.



THE ROTATING DRUM, WITH END OF SHAFT PROJECTING.



THE MIGHTY STERN, SHOWING THE POWERFUL RUDDER PROTECTED AND PIVOTED WELL BELOW THE WATER LINE, AND TWO OF THE THREE GREAT PROPELLERS.

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The bow riveters ranged from 52 in. to 69 in. gap. The main casting is in Siemens-Martin steel, the piston is a

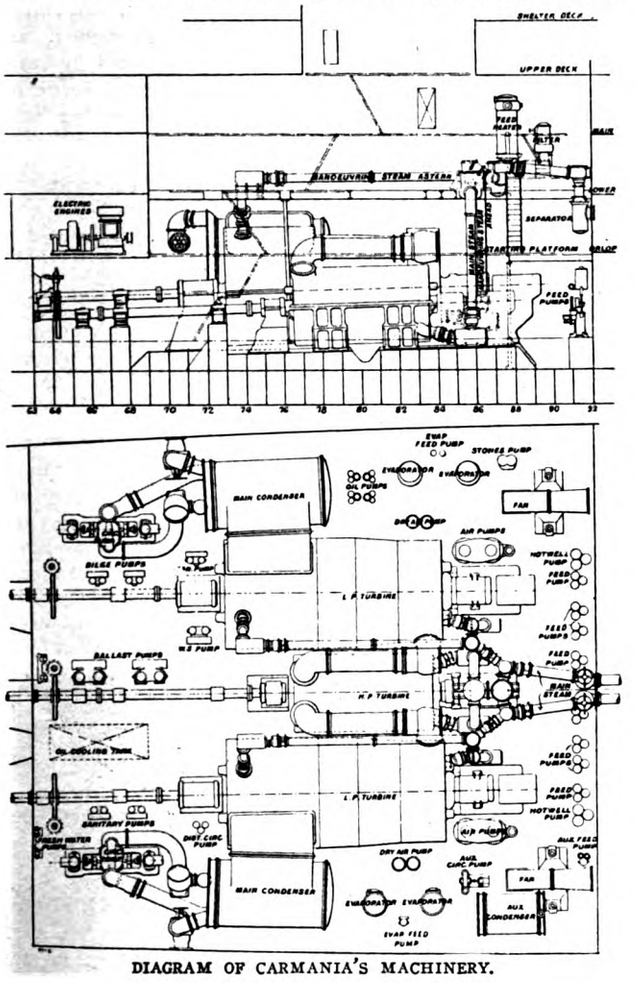
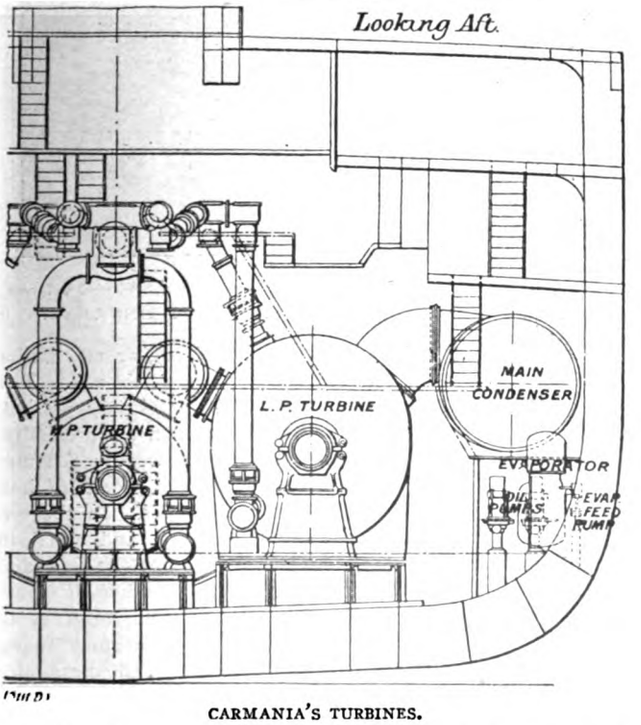


DIAGRAM OF CARMANIA'S MACHINERY.



CARMANIA'S TURBINES.

steel forging, and the cylinder is lined with gun metal; the operating-valve is of the piston type and is in gun-metal. A projecting web is carried round the back of the outer flange, and is bored with a close pitch of bolt-holes, so that the machine can be slung with the dies either in a horizontal or a vertical position.

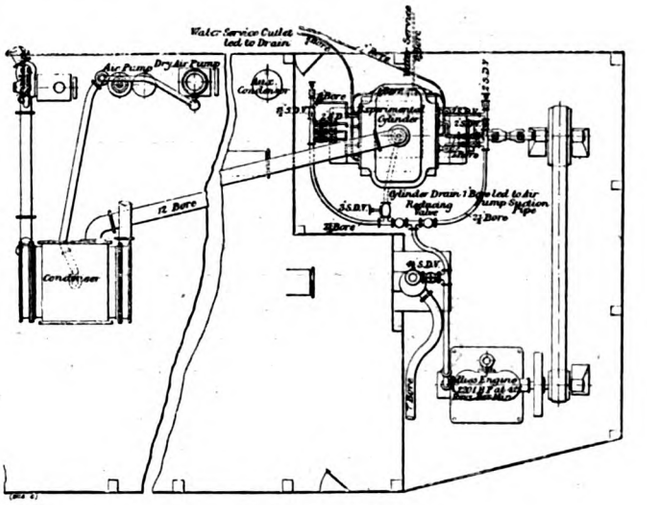
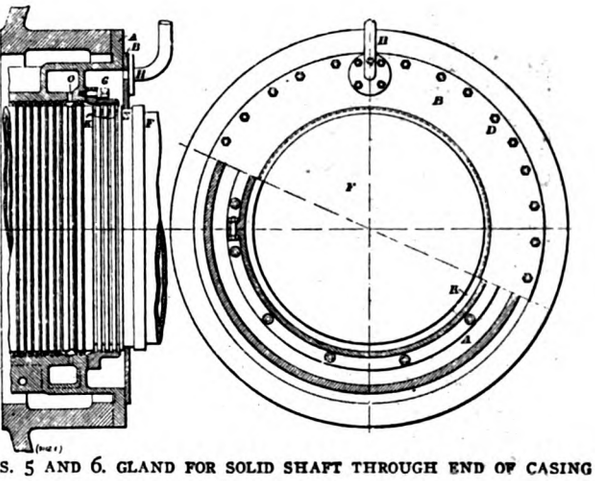
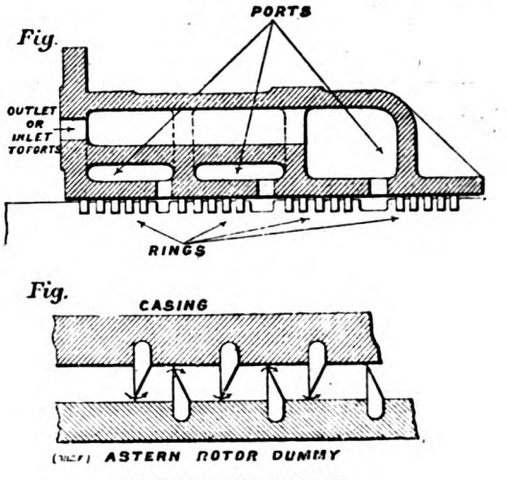


FIG. 4. GLAND TESTING PLANT.



FIGS. 5 AND 6. GLAND FOR SOLID SHAFT THROUGH END OF CASING IN CARMANIA.



ASTERN ROTOR DUMMIES.

The plating of the inner bottom up to the margin plate averages 4 ft. in breadth of strake and about ¾ in. in thickness. It is, however, thicker in the boiler and machinery spaces, where further strength is imparted to the

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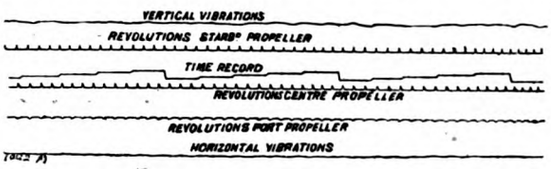
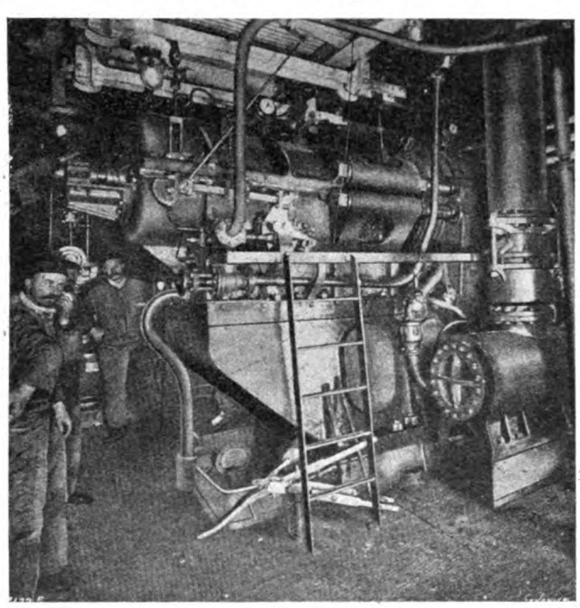
structure by a greater number of longitudinal girders built intercostally with the floor-plates. This inner plating is lapped, and triple-riveted at the butts and double-riveted at the edges.

There are twelve bulkheads, built of ½-in. plating, with 10-in. channel stiffeners extending to the lower deck and spaced 30 in. apart. These are connected by large brackets to the tank-top plating and to the lower deck, and are joggled at the laps of the plating. Above the lower deck



CARMANIA'S VIBRATIONS.

the stiffening is, by means of angles and flanges in the bulkhead plating, 7 in. and 5 in. deep respectively. The doors through the water-tight bulkhead are operated by the Stone-Lloyd system. This system enables the officer on the bridge, by means of hydraulic mechanism, to close all the doors simultaneously, adequate notice being given to all in the vicinity of each door by the ringing of a bell. Indeed, the hydraulic valve is only unlocked to bring the gear into operation by gear which, of itself, rings the warn-

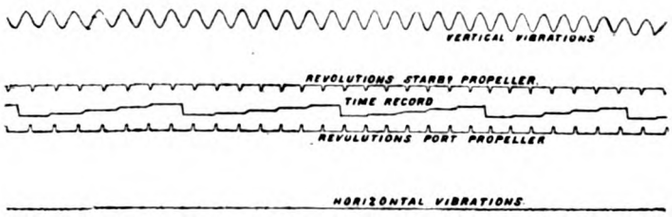


VIEW FROM CARMANIA'S ENGINE ROOM FLOOR SHOWING GOVERNOR AND ADJUSTING BLOCK.

ing bells. The doors can also be operated by valves at each bulkhead; but in the event of the officer on the bridge having closed the door, it can be kept open for a time only sufficiently long to enable anyone to escape from one compartment to another. In this way there is no chance of anyone being imprisoned in a compartment by the simultaneous closing of all doors from the bridge, as he can easily liberate himself when the officer has closed the doors from the central station.

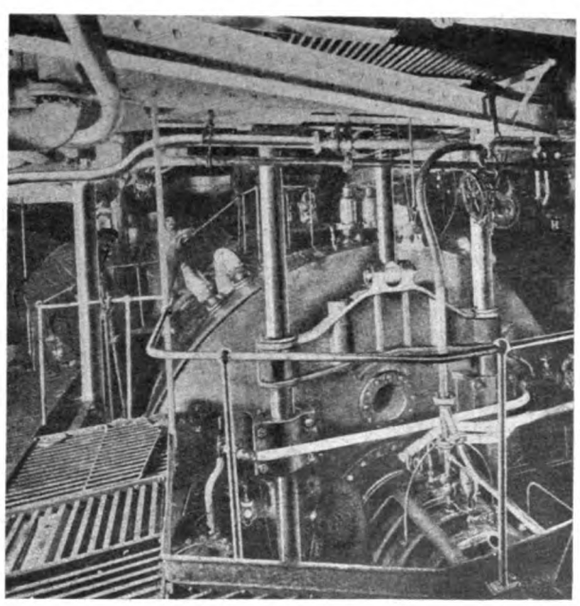
The tunnels for the propeller-shafts are built up of steel plates and angles of similar scantlings to those of the main bulkheads. Two are built against the side of the ship, and the center one with a top of semi-circular section at a lower level. A novel feature in these ships is the construction of a fore-and-aft tunnel, or conduit, passing through the forward holds. Through it are carried all steam-pipes, hydraulic mains, electric leads, etc., so that these can be examined at any time without disturbing the cargo space or other parts of the ship.

The deck beams are of deep channels throughout, and are connected to the framing by knee-brackets hydraulically riveted. The various decks are supported vertically, and tied together by solid circular pillars, varying from



CARONIA'S VIBRATIONS.

6½ in. to 3 in. in diameter. These are to Lloyds requirements in spacings and scantlings, as, indeed, are all scantlings of the ship's structure. The deck-plating is, on an average, about ⅝ in. thick, but is heavier where required—principally in the stringers or outside strakes of the deck-plating, which are usually 1 in. and upwards in thickness, with extensive doublings in the main structural decks. The laps are joggled and double-riveted generally; the butts are also joggled and triple or quadruple riveted.



VIEW FROM CARMANIA'S STARTING PLATFORM SHOWING STARBOARD LOW-PRESSURE TURBINE WITH LIFTING GEAR.

At the corners of the hatchways and engine and boiler casing openings there are heavy plate doublings. The coamings of hatchways, which are also of heavy plating, also add to the strength of the structure in their vicinity. To replace the ordinary deck beams removed in the machinery openings, there are special strong beams of box section built up of heavy plates and angles. In the engine-space openings they are 15 in. deep, and equal in width to the distance between the frames—32 in.—and are connected by heavy angles. They extend both transversely and longitudinally, and are arranged, both as to position and spacing, to permit of the turbines being raised from the machinery compartment. In the boiler space they are of heavy box section, of great depth, securely gusseted to the structure at the ends.

As the lower decks of the ship are complete only at

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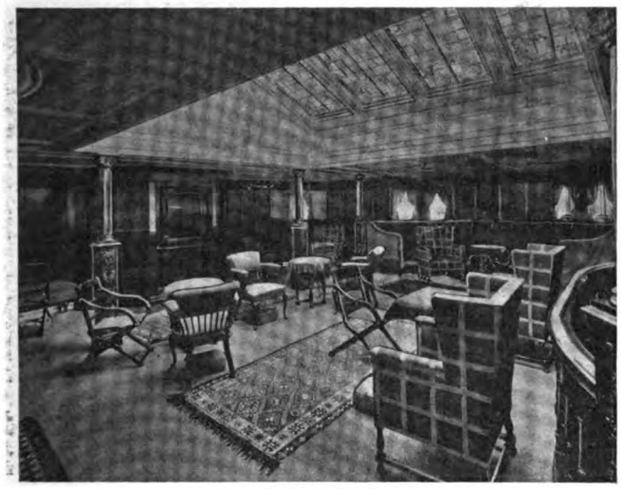
the bow and stern, the longitudinal strength in the central part of the ship is maintained by girders or stringers. They are fitted between the webframes, and hydraulically riveted before being connected with the main structure.

The engine-seating is of the simplest character. The double bottom is constructed throughout with the same lines of longitudinals, and the inner floor worked at the same height, as in the boiler spaces. Upon this



THE LOUNGE ON THE CARMANIA'S BOAT DECK.

structure fore-and-aft box-girders were worked. Upon these girders supports for the turbines were immediately bolted. As the reciprocating stresses are eliminated, and the propeller thrust is almost steam balanced, the structure for carrying the turbines in the Carmania was lighter than for the reciprocating machinery in the Caronia.

The stem of the hull is of forged steel, and of the usual Cunard outline, with a long sloping fore-foot. The stern-post and brackets are of cast steel. The center propeller-

FIRST CABIN DRAWING ROOM ON CARMANIA.

shaft passes through an aperture as in a single-screw ship, and the stern-post, after arching up to give satisfactory clearance over the tips of the blades, is carried down abaft the propeller very nearly to the level of the center shaft, for the purpose of giving sufficient length of bearing for the rudder-spindle. Higher up, the post is considerably swelled, in order to satisfactorily house the steering-gear, which is placed beneath the waterline to meet Admiralty requirements. In designing the shape of the post, every care was taken to ensure clean entrances, in order to reduce friction and eddy-making to the lowest possible extent. The rudder is of cast steel, in three parts, connected together by heavy horizontal flanges, and, as will be seen, revolves on two pintles, which, together with the gland at the head, form the whole support against sideway pressure when maneuvering. The rudder is wholly below the waterline, and its area is 270 sq. ft.

DESIGNING CARMANIA'S TURBINES.

Messrs. John Brown and Co. realized that it was absolutely necessary to impart a thorough practical knowledge to their staff as to the methods of manufacture and the actual running under sea conditions of the turbines themselves, and that it would not suffice for their officials and foremen simply to see how the work was carried out at Messrs. Parsons' shops. It was therefore decided, as a preliminary to the design and construction of the Carmania's machinery, to make a set of three-screw marine turbines, capable of developing about 1,800 H. P. Designs for these were obtained from Mr. Parsons, embodying all the improvements suggested by his latest experience. Work on these turbines was proceeded with night and day continuously; and when completed they were erected on land, together with a full equipment of condensing plant and auxiliary machinery, consisting of a surface condenser, centrifugal circulating pumps, Weir's dry

FIRST-CLASS DINING ROOM ON CARMANIA.

and wet air-pumps, oil and water service, and all other fittings exactly similar to those required for working the turbines on board ship. The turbines, however, were coupled direct to powerful dynamos, whose efficiency had been accurately determined and the energy generated by them was dissipated by means of a water-resistance tank. The whole system, in conjunction with carefully calibrated measuring instruments, formed an efficient and convenient means of measuring the output of the turbines.

One of the illustrations gives a good idea of the general arrangement of the experimental plant, and shows the powerful dynamometers which were fitted at the forward end for measuring the thrust of the steam, which, in actual working conditions, would be balanced by the thrust of the propellers. Exhaustive trials were carried out over a period of six months, giving most valuable data as to the steam consumption, reliability, and the relative power of ahead and astern turbines, under all possible conditions likely to be met with in actual practice. Thus the steam consumption and torque were obtained when working ahead with all the turbines, when working ahead with the low-pressure turbines only, and when working ahead with one high-pressure and one low-pressure turbine only. Experiments were made with varying numbers of rows of blades in the astern turbines.

In consequence of this, it was not until August, 1904, that

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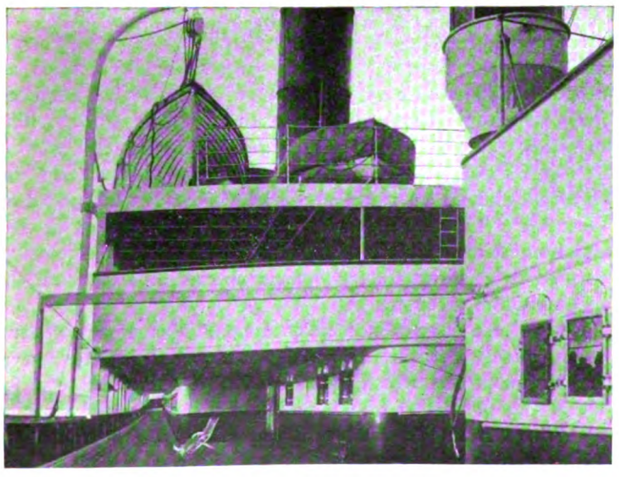
the work on the turbines of the Carmania was actually commenced. But in the interval, in addition to the construction of the 1,800-H. P. set of turbines, numerous experiments were carried out to determine the best form of stiffening necessary to enable the cylindrical casings to resist distortion when subjected to high-temperature steam, and also to discover the best means of allowing and providing for the

CONNECTING STATEROOMS WITH BATH BETWEEN ON CARMANIA.

expansion of the different component parts of turbines of such large size.

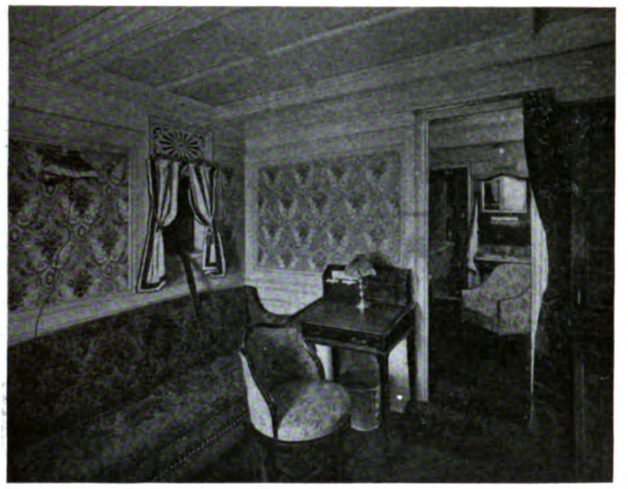
The drawings of the arrangement of machinery in the Carmania shows that there are three shafts; the high-pressure turbine being on the center shaft, and one combined low-pressure and astern turbine on each of the two wing shafts. The space occupied, as far as area is concerned, is the same; but the engine compartment is roomier, and there are immense advantages in the absence of reciprocating parts.

There is a saving in weight by the adoption of the turbine



CARMANIA'S LOWER PROMENADE DECK LOOKING FORWARD.

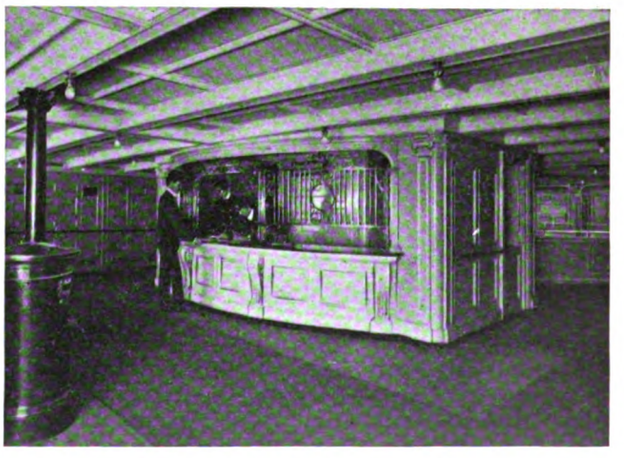
system of about 5 percent, in addition to many other advantages which need not be referred to here. The boiler pressure in the Caronia is 210 lb., and in the Carmania 195 lb. per sq. in. The turbines take steam at an initial pressure of 150 lb., as against 200 lb. in the quadruple-expansion engines. Another feature in the comparison which might here be commented upon is that, owing to the high vacuum desirable in the turbine system to ensure the fullest economy, the condensing surface, which in the Caronia is 27,030 sq. ft., is increased in the Carmania by 20 percent, while the capacity of the centrifugal pumps is about doubled so that the amount of circulating water discharged is from fifty to sixty times the weight of feed-water as compared with a ratio of twenty-five to thirty times in the Caronia's installation. The main condensers are built of steel plates, with brass ends and



DE LUXE FIRST-CLASS ACCOMMODATIONS ON CARMANIA.

doors, and the cooling surface consists of solid-drawn brass tubes, tinned inside and out. The circulating water is supplied by two large centrifugal pumps, each driven by two engines, constructed by Messrs. W. H. Allen, Son & Co., Ltd., Bedford. To the air and other pumps we shall refer in detail later.

The tunnel and propeller-shafting are of steel, manufactured at Messrs. John Brown & Co.'s Atlas Works. The propellers are three-bladed, with Firth's cast steel bosses and manganese-bronze blades. They have been accurately balanced, and the working faces chipped and polished to a true helical surface.



PURSER'S OFFICE ON CARMANIA.

One of the most interesting features in the construction was the blading of the turbines—a task, the magnitude of which it is difficult to conceive. Each blade throughout the turbines was put in place, caulked, correctly set, and individually inspected; and when it is mentioned that the total number of blades amounts to about 1,115,000, some idea may be got of the work involved. To give radial stiffness to the longer blades of the low-pressure turbines, they are

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bound together by two circumferential strips, laced with copper wire and soldered. These, as first designed, were in one piece; but experiments carried out at Clydebank showed that, in these large turbines, the difference of expansion of the drum and brass strip tended to cause distortion of the rows of blades under working conditions. This difficulty was overcome by means of ingenious expansion joints designed and patented by Messrs. John Brown & Co., Ltd. These allow for the inequalities of expansion, and entirely do away with the buckling of the row of blades.

In order to reduce vibration to a minimum, special attention has been given to the balancing of the revolving parts. The propellers and each component part of the rotors have been severally balanced in detail, statically on knife-edges, and dynamically in a machine designed and constructed by Messrs. John Brown & Co. for this purpose. After the rotors were completely finished, they were placed on knife-edges and tested and adjusted. The massive cast-iron blocks supporting the knife-edges are placed on solid concrete foundations, 8 ft. deep, and the edges have been leveled up to within two-thousandths of an inch of each other. As a final test of the accuracy of the balancing, the rotors were put in place and the turbines run under steam, at revolutions considerably in excess of those required under actual working conditions, and the total absence of vibration fully compensated for the care and attention which had been given to the subject; for although the reciprocating engines of the Caronia left little to be desired as far as the absence of vibration is concerned, the turbines of the Carmania excelled the engines of her sister ship in this respect, as in many others.

THE VALVES, GOVERNORS, AND LUBRICATION.

In normal working conditions the regulating-valves admit steam to the high-pressure turbine, and the steam passes through it to the low-pressure turbines, and thence to the condenser. For maneuvering purposes, a large non-return valve, worked by a steam and hydraulic engine, controlled from the starting platform closes the connection between the high-pressure and each low-pressure turbine; this valve is semi-automatic, inasmuch that, if not closed before maneuvering, it will close as soon as a prescribed pressure is attained in the low-pressure casing; each of the low-pressure turbines is then manipulated as an independent unit. Special maneuvering-valves are fitted to each of the combined low-pressure and astern turbines, and operated by steam cylinders which allow of steam being admitted to either the ahead or astern turbines by a single movement of a hand-lever.

Governing-gear is fitted to each of the turbines, and is so arranged that any increase beyond 10 percent in the revolutions of any of the turbines shuts off the steam supply from the turbines until the revolutions fall to the normal speed. An emergency governor is provided to entirely stop the turbines should any serious increase in the revolutions take place. On the maiden trip the racing of the screws was at no time sufficient to disturb the governor.

Special attention has been paid to the lubrication of the main bearings and adjusting-blocks. Four pumps, by Weir, are fitted, which deliver oil to the bearings under considerable pressure. The oil then flows to a cooling-tank, fitted with copper coils, through which water is circulated; and after passing through a system of oil-filters, is again delivered to the bearings. The bearings are also made hollow, and a complete water circulation provided through them.

THE TURBINE GLANDS.

The gland for the shaft passing through the end of the turbine is rendered steam-tight by means of an improved design, illustrated herewith, the result of a series of experiments which involve much thought and expense. In all Parsons' marine turbines hitherto, the leakage of steam in the high-pressure turbine, or the ingress of air into the low-pressure turbine, along the spindles where they pass through the cylinder casings, has been prevented with remarkable success by the Parsons well known ring-and-groove type of gland. This gland consists of a series of grooves turned in the spindles, into which bronze Ramsbottom rings are fitted, the whole rotating in a truly-bored cylindrical gland. When the difference in pressure between the inside of the turbine and the atmosphere is great, the side pressure on these rings is very considerable; and in order to distribute this pressure as equally as possible over all the rings, Mr. Parsons adopted the ingenious method of grouping these rings into, say, two, three, or four groups (depending on the range of pressure), and grading the pressure to each group, either by admitting steam or leaking off steam to the space between the groups. Moreover, to ensure equal distribution, large annular recesses were cast round the gland, pressure gauges being connected to each space to aid in the regulation of pressures.

During the early stages of the construction of the turbines for the Carmania, Messrs. John Brown & Co. realized that as the vacuum obtained depended mainly on the tightness of the low-pressure glands, it was necessary to make experiments to ascertain whether the form of steam gland above mentioned would prove equally satisfactory in the case of spindles of such an unusual diameter as were required in the Carmania. To obtain this information, they conducted a series of experiments, extending over a long period of time, with the glands proposed for the Carmania. These were first made in accordance with the Parsons ring-and-groove type already described. The tests necessitated the making of a cylinder to contain the glands, with a spindle fitted through it, similar in all respects to that proposed for the Carmania. All the various parts were carefully put together, special care being taken to observe the precise conditions which would obtain in the actual running at sea of the turbines. A special testing-house was erected to carry out these tests, and was provided with a steam-engine, condenser, circulating-pumps, wet and dry air-pumps, and all other fittings necessary for recording the results of the experiments.

The first experiment was conducted under conditions similar to those which hold for the high-pressure turbine, in which case the pressure in the cylinder is considerably above the atmospheric pressure. This pressure was determined by theoretical calculation, and was kept constant inside the cylinder during the whole period of the tests, which were severally conducted night and day continuously without a stop for full a week—equal to the period of an Atlantic voyage. The spindle was rotated at the designed number of revolutions per minute; and to ensure that the belt-drive should not disturb the free running of the spindle, universal joints were adopted, as seen in Fig. 4. Gauges were fitted to the cylinder and to all the ports in the glands, to record the various pressures, those in the gland-ports having a gradual drop from the cylinder to the atmospheric pressure. This was accomplished by a series of pipe and valve connections, whereby steam at a reduced pressure could be introduced into these ports, or steam leaked off from the ports into the atmosphere, as circumstances necessitated. In spite of all these precautions the rings gave very unsatisfactory results, the noise due to rubbing being positively alarming at times, and causing a large amount of wear on the rings. The particles of brass rubbed off were blown out by the slight leakage of steam at the outside of the gland, and deposited on the side of the bearings. Some of the rings after a week's running would have as much as 20 percent worn off them. Rings of various compositions of alloys

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were tried, grooves were cut in the sides, leak-off holes pierced through the rings, but all without any improvement.

Minute investigations of the scored and torn rings led to the conclusion that the differences in pressure between the successive groups of rings practically all came to bear sometimes on the first and sometimes the second ring of each group; and after scoring and tearing them the particles of brass passed through to the next adjacent ring, damaging it in turn, and so on. At the surface speed of the Carmania's spindles a difference of pressure of more than 3 lb. per square inch was not admissible. As the vacuum represented 14 lb. per square inch, and the inlet steam at the outside end must, for practical purposes, be taken at from 2 to 3 lb., this would have meant six groups of rings, with the corresponding number of leak-off pipes, regulating-valves, pressure-gauges, etc., for each gland. Such a complication was, of course, impracticable. A means had, therefore, to be obtained by which the pressure or vacuum, as the case may be, would automatically lower itself; and then, by means of a single regulating valve, pipe connection, and pressure-gauge, the first Ramsbottom ring would only be exposed to the safe working pressure of from 2 lb. to 3 lb. per square inch.

After further experiments, it was found that this desired result could be readily obtained by the adoption of the radial fins devised by Mr. Parsons for the prevention of leakage for his internal astern rotor dummies. It will be readily seen that the action of these fins is to alternately wire-draw and expand the steam, each pair constituting an expansion stage, thus reducing its pressure as it travels outwards.

The actual gland, as fitted at each end of both the high and low-pressure turbines of the Carmania, is illustrated in Figs. 5 and 6, in which it will be seen that these radial fins extend along the greater part of the gland with four Ramsbottom rings K at the outer end; and the small amount of steam which is allowed to leak past them for the purpose of lubrication is caught in the pocket G formed by the plate B, whence it is led by the pipe H to the auxiliary condenser or exhaust-tank. In the case of the high-pressure turbine, should the radial fins not sufficiently reduce the pressure of the escaping steam, the pocket O is connected to an expansion row in the low-pressure turbines, where the pressure, even at full speed, is just below the atmosphere; so that by means of one regulating-valve for both ends— the handle for which and the pressure gauge from the pocket O are on the starting platform—the pressure in this space can be maintained at a few pounds pressure. In the case of the low-pressure turbines a small steam pipe, similarly regulated, is led to the space O, and the pressure in this space maintained at from 2 lb. to 3 lb. per square inch, which absolutely prevents any leakage of air into the gland. The quiet working of these glands, and the absence of the usual steam vapor leakage past them, was generally commented on; whilst the high vacuum maintained in the condenser—sometimes as high as 20 in., with a 30-in. barometer—testified to their efficiency.

THE CARMANIA'S BOILERS.

The boiler installation is practically similar to that of the Caronia, except that working pressure is 195 lb. instead of 210 lb. per sq. in. There are eight double-ended and five single-ended boilers, arranged in two separate boiler rooms. They are designed to work under Howden's system of forced draft; and two large fans, each driven by two engines, are supplied for each boiler room. The funnels are two in number, elliptical in shape, and rise to a height of 135 ft. above the furnace bars. The boilers have 2.35 sq. ft. of heating surface per unit of designed power (21,000 indicated H. P.), while the ratio of power per unit of grate surface is 17.3 I. H. P. The boilers of this ship, as well as the boilers and engines of the Caronia, were evolved from the machinery of the Saxonia, which, when tested by the Navy Boiler Committee, were found to require only 13.4 lb. of steam per indicated H. P., the boilers giving 11.30 lb. of steam per pound of coal, while the coal consumption per unit of power was 1.29 lb. per hour. The Caronia has proved equally economical, and, as we have already remarked, the turbine machinery has thus a severe task set in order to excel in economy this standard of excellence.

THE TRIALS.

The trials of the Carmania occupied practically only one week from the time the vessel left the Clydebank Works, the performance of the ship being exceptionally favorable from beginning to end. The steaming tests excited very considerable attention among marine constructors, and were attended by representatives of several important interests.

The Carmania left the Clydebank Works of Messrs. John Brown & Co., Ltd., on the 14th ult., and on the following day had her preliminary trial. As this proved quite satisfactory, it was decided to run the first of the official trials on Friday, the 17th ult. This trial consisted of four runs over the measured mile at full speed, the vessel subsequently continuing, at the mean revolutions developed on the measured mile, to complete a continuous steaming trial of six hours' duration. The actual speed maintained was 20.19 knots. As to the second official trial of six hours' duration, on the 21st inst., it had been decided to run at between 19 and 20 knots, to represent the normal sea speed of the vessel. Over the whole course a speed of 19.5 knots was maintained. Thus, in respect of speed, the conditions were more than fulfilled.

As regards vibration, records were taken with Schlick's pallograph for measuring and registering vibrations, and there is reproduced herewith a part of the graph made, taken at random, with a corresponding record to the same scale from the Caronia. Whereas in the twin-screw reciprocating engine ship there is a slight vertical vibration with regularity of period, the disturbance in the Carmania is practically nil. The horizontal vibrations are indistinguishable.

Regarding steering, in coming down the tortuous channel of the river the turbines were alone relied upon for a considerable length, owing to a slight mishap with the steering gear. It was hoped that before entering the Mersey, on the 22nd. ult., circling trials would be possible at full speed, but owing to the squally and lumpy weather, which was then rapidly getting worse, these could not be completed, as it became necessary to pick up the mark boats. During the progressive speed trials on the Clyde a turning test was made. Immediately after the last run, which was at 15.7 knots, the rudder was put hard over, and the vessel was turned through sixteen points—an exact reversal of bearing. The time taken was 3 minutes 34 seconds from giving the order to the steersman. Allowing for the falling off in speed, well known to take place when circling under large helm angle, this results in a "transfer" of about 3,200 ft. This observation is the more valuable as it was carried out in windless weather, in smooth water, and at slack tide.

The progressive speed trial data are not of practical utility, because of the difficulty of actually determining the H. P. The full speed guaranteed by the contract was 19 knots; but on the first six hours' run 20.19 knots was maintained easily, both as regards machinery and boilers. The official results of the four runs over the measured mile at Skelmorlie are appended:

	Speeds. Knots.	First Sums.	Second Sums.	Third Sum.
First run	20.57	40.51		
Second run	19.94	40.28	80.79	161.52
Third run	20.34	40.45	80.73	
Fourth run	20.11			

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The "mean of mean" speeds is therefore 20.19 knots, the final mean being found by continually dividing the last sum by two for as many times as summations are made; in this case three times gives the true mean speeds. It is to be noted that the true mean speed quoted is less than would result from the adoption of the not uncommon practice of simply taking the arithmetical mean of the speeds in the four runs, which give a rate of 20.24 knots. The speed realized is especially satisfactory in view of the fact that the vessel had not been docked since her launch in February last, and consequently the large submerged area was coated with slime and chemical deposit carried in suspension in the waters of the Clyde. But as the speed was so much in excess of that guaranteed, and as it had been determined, a month or two ago, to place the vessel on her station, so that she might start on her first voyage on Dec. 2, it was decided not to run trials, after docking the ship for the cleaning of the hull. In the case of the Caronia practically the same time had elapsed between the launch and her first trial, and when the second trials, with a clean hull, were run the difference in speed, as compared with the speed with a foul surface, was found to be half a mile per hour. In other words, the Caronia, steaming under the same conditions as the Carmania on Friday last, had a speed of over one nautical mile per hour less than the Carmania. This is attributable to the adoption of the turbine system; the efficiency of the propellers is evidently very satisfactory. With a clean hull there is no doubt that the Carmania will have a speed of 20.6 knots, as compared with 19.5 knots in the case of the Caronia.

As regards the coal consumption, it was not possible to take any data. Moreover, six hours was too short a period in which to secure reliable information; but if one may judge by careful observation of the work done by the stokers in the two ships, then the promise is that the coal consumption measured on the Atlantic will compare well with the very satisfactory performance in this respect of the Caronia. No effort was made on the maiden trip to compile any coal consumption data.

DESCRIPTION OF PASSENGER CONVENIENCES.

There are eight decks on both Caronia and Carmania. Below the boat deck they are lettered, for the sake of convenience, from "A" to "G." On the "A" deck is situated the magnificent smoking room, paneled in oak, relieved with masses of old gold. In this home-like room, a large open fireplace, surrounded by a mantel of hammered copper, adds a warm and attractive feature. An unusually large assortment of easy chairs and lounges, quite unlike those ordinarily found on ocean steamships, completes the furniture of this most attractive room, which has more the appearance of a comfortable living room in a country house than an apartment aboard ship. The upholstering is in mellow colors, which blend perfectly with the surroundings. The room is thoroughly lighted, not only from the square port windows on either side, but by a handsome skylight above.

On this same deck is found the combined writing and drawing room, the tables being covered with red leather, the lamps over each table being furnished with shades of the same hue. This color blends perfectly with the curtains and the drapery at the two entrances. On either side of the apartment, which contains a grand piano, several rich lounges and many easy chairs, is a cosy alcove with handsome open fireplace, and mantel, in Fleur de Rose marble. The carpeting of rich red adds just the neccessary color tone to make this royal apartment most effective to the eye. Many of the choicest of the staterooms are located on this, the upper promenade deck. A number of them are en suite with bathroom, while the more pretentious ones consist of bedroom, parlor, bathroom and toilet room, and are in appointment and finish the equal of any room ever seen on ocean steamships.

On the boat deck is found an absolutely new feature in marine appointments. This is designated a "Lounge" or "Palm Room" in which coffee and light refreshments may be served from a buffet, and the gentlemen may be joined by the ladies while enjoying their after-dinner cigars. The color scheme is in peacock blue with carpet to match, and the sameness is relieved by brighter colors in the form of handsome rugs and gold paneling upon the sides of the room.

As one descends the stairs leading from one deck to another, he finds several decks assigned to staterooms. On each of these decks there is evident the most careful and considerate arrangements looking toward the comfort and luxury of everyone taking passage on these magnificent ships.

There are to be noticed throughout Caronia and Carmania many novelties, as, for instance, on the promenade deck, conveniently located, a superbly polished mahogany counter, in semi-circular form, surrounded by an ornamental brass railing and serving the purpose of the customary hotel office. In this department is a steel-lined treasure chamber, a miniature safe-deposit vault, containing a massive safe wherein travelers' valuables may be deposited. Near here, too, is a stenographic room, in charge of a stenographer. Throughout this deck, as well as the others, the visitor is struck by the spaciousness of the passages and the breadth of the stairways. All over the ship there are signs giving information as to the numbers of rooms to be found in each passage, and various other information, reminding one almost of the street signs in a city thoroughfare. There is on this deck not only the barber shop, handsomely equipped, the doctor's room and consulting rooms, but other conveniences for passengers' uses.

The principal feature of deck "C," the so-called saloon deck, is the magnificent first cabin dining saloon, extending the full width of the ship, just about amidships, and capable of seating 300 passengers at one time. The rigid and formal line of tables usually found in the dining rooms of ocean steamships has been omitted. A large number of small tables, such as are found in the metropolitan cafe, have been substituted. The woodwork of this superb apartment is in carved mahogany with white enamel finish and with a sufficient touch of gold to add warmth. The outlines of the room are broken by a number of alcoves, formed by graceful arches and pillars.

The roof of this saloon is pierced by a large octagonal opening forming a "clerestory" surrounded by a corridor above. The angles of this octagon are relieved by fluted Ionic pillars. This is in keeping with the architectural treatment of the entire apartment, the pillars being interspersed with panels in Jacobean carving. The same decorative scheme, but in a higher relief, is shown in the frieze surrounding the entire saloon, which harmonizes perfectly with the capitals of the columns, and the ceiling which has received similar treatment.

The draperies and upholsterings of this saloon are in a rich crimson, forming a charming ensemble, most restful and pleasing to the eye and giving distinct warmth to the apartment.

There is perhaps one feature of the esthetic portion of the Caronia and Carmania more noticeable than the entire absence of the spectacular in decoration. Perfect taste has been used in every part of the ship, and this is particularly noticeable in the special staterooms, where the paneling of silk tapestry harmonizes perfectly with the carpets and upholstering of the furniture.

Upon the same deck with the first cabin dining-room is the large and comfortable second cabin dining-room. This also extends across the entire width of the ship, insuring both light and ventilation from the large square ports. It is handsomely appointed, and it is doubtful if any ship crossing the ocean until within the last few years was equipped with a first-cabin dining-room as handsome or in which there was such perfection of convenience.

Immediately over this room, on the deck above, are the sec-

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ond cabin drawing and smoking rooms, provided with every comfort found in the first-class apartments, but different only in the degree of their luxuriousness.

No ships afloat have such satisfactory sanitary and commodious third-class accommodations as the Caronia and Carmania. Individual staterooms are provided for 2,000 persons so that the passengers may enjoy the privacy only secured formerly by passengers who paid the higher rates. There are two, four, and six-berth rooms, the latter being for families. Each berth has a spring mattress and warm and cleanly bed linen.

The third-class dining hall is a light and airy apartment also running the full width of the ship, paneled in sycamore, which will seat 560 persons at one time. The tables are provided with swivel chairs, clean linen, and the food served includes meat three times a day. There are for this class of passengers smoking and ladies' rooms as well as spacious covered-in promenades. Everything that modern science has devised looking to sanitary excellence is found in this department of the ship. There is a lavish supply of baths, including shower baths. The ventilation is upon the most approved system, and all of the alleyways, staterooms and public rooms, are supplied with an abundance of pure air. It may be safely asserted that in the Caronia and Carmania the third-class passengers have all the comforts and conveniences enjoyed by those in second cabin on other ships of but a few years ago.

Early in 1907 the two great turbine ships of the Cunard Line, which are expected to make over 25 knots an hour, and reduce the ocean trips to close on to four days, will be put in service.

GAS ENGINES FOR LARGE VESSELS.

On the subject of the use of gas engines for marine purposes, the *Glasgow Herald* recently said: "It is significant of the progressive attitude of the technical officers of the admiralty—especially in the engineering branch—that they decided to apply experimental gas engines with producers instead of steam engines and boilers for the propulsion of large vessels, before any ship owner was found with courage to essay a departure, though experience in land stations promises most economical results. An installation now being constructed at Manchester will be applied by the admiralty; and as the power to be developed is 500 B. H. P., it will be recognized that the test is to be on a thoroughly practical and searching scale. While thus giving credit to the admiralty, it is but fair to make mention of the splendid pioneer work carried out, and being continued by Mr. William Beardmore, of Glasgow, in this respect, alike for marine and for land work. It is now some years since Mr. Beardmore took up the work, acquiring the British rights in the Oechelhaeuser engine, one of the simplest and most popular of the Continental designs. The success of the application of this horizontal engine, several of which are now in use in the west of Scotland, led him to investigate fully the adaptability of the system to marine work; and now there is being built a 500 and a 1,000 H. P. installation for ships, and these may be ready for use before the admiralty sit. An effort is to be made to use the cheapest bituminous coal for the generation of the gas for the engines; and there seems every chance of success, with a satisfactory method of purifying the gas to prevent the clogging of valves. Should this be realized, and the consumption come out under 1 lb. per horsepower per hour, the coal bill will be halved, and at the same time more room will be made available for cargo by the reduction of the size of engine rooms.

Mr. John F. Craig of Toledo has been elected commodore of the Toledo Yacht Club.

WATER TUBE BOILER DESIGNING AS A SCIENCE.

BY ELBRIDGE GERRY ROBBERTS.

It is very much more difficult to design a water tube steam generator for marine practice than for use on dry land, in consequence of the many more details to be taken into consideration to meet the increased number of conditions necessary to be considered on board ship.

Therefore, in considering this question from a scientific point of view, the higher art undoubtedly lies in marine practice.

Of course, there are any quantity of marine water tube boilers in use, more or less varied in their design, but almost without exception they are all alike in one particular. They consist simply of a bunch of generating tubes, in which, in some cases, the gases of combustion travel naturally of their own accord, through the major portion of these tubes, while with others it is necessary to use artificial means, such as baffle plates, to direct the gases in a roundabout, circuitous manner in order to coax them to come in contact with all, or nearly all, of the heating surfaces.

Naturally, where it is necessary to use baffle plates, they burn out; and, if the people who have charge of the operation of the boilers are not too lazy, the baffle plates are renewed. Where it is neglected—and I know from personal experience of many things in connection with water tube boilers which are continually neglected—the baffle plates are not renewed and the gases get out of the stack with the expenditure of the least energy possible in a direct line.

For the reason just specified, and also for the reason that each tube is taking fresh comparatively cool water from the side pipes, or bottom manifolds, it would appear that the various types of boilers in use which do not have baffle plates but permit the gases to take their own course, such as the "Mosher", "Yarrow" etc., are the nearer right scientifically.

In some of the types of boilers provided with baffle plates, such as the Normand, for instance, the gases are directed back and forth several times over the generating coils. The water starts from the bottom of the boiler comparatively cool, while the gases of combustion are the hottest just as they leave the fire. They come in contact with the first generating tubes immediately over the furnace and impart a certain amount of their heat units to these tubes. Consequently the gases are cooler and the water warmer than in the first stage. The baffle plates then return the gases over the generating surfaces a little higher up and again, naturally, more heat units are absorbed, again cooling the gases proportionately and heating the water contained in the generating tubes. Consequently as this process continues, the gases becoming cooler and the heating surfaces hotter, the temperatures of the gases and the heating surfaces are approaching each other closer and closer.

Heat units have a tendency to pass through the tubes into the water much more readily and with greater rapidity, as is well known, as the difference in temperature between the gases and the heating surface is increased.

Consequently, in designing a water tube boiler properly, the heating surfaces should be cooled constantly, as the gases contact while proceeding toward the chimney, thus preventing, to a large extent, the reduction in difference in temperature between the gases and the heating surfaces during the transit of the former.

Where this is accomplished, the rate of heating surface to grate surface does not have to be anywhere near as great as is popularly supposed by people who are not

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conversant with boilers having heating surfaces scientifically arranged, but with boilers only that have heating surfaces composed simply of a "bunch of generating tubes" as referred to above.

As I said in the beginning of this article, marine practice requires the most thought, and I have so far, simply been working up to the point that on board of a vessel, light weight, small space occupied, low center of gravity and great power are desired.

Now, therefore, if the heating surfaces are arranged in a manner which obviates the necessity of a very high ratio of heating surface to grate surface, the same results may be obtained in much less space and with much less weight, inasmuch as the heating surface is what weighs in a boiler. The material used in the construction of a boiler can almost entirely be classed as "heating surface". Consequently, to increase the latter naturally increases the bulk and weight proportionately, and it therefore seems to me that the best boiler for marine use would be one that, with a ratio of only 34 of heating surface to 1 of grate surface, could show an actual evaporation of 12.43 lbs. of water per sq. ft. of heating surface at an actual average steam pressure of 256 lbs. and show a stack temperature of only 285 degrees Fahr. in excess of the temperature of the steam.

Now, for instance, suppose it were possible to design a boiler in such a way that the gases, of their own accord, naturally, without the use of baffle plates or other artificial means, would pass, first, successively through a bunch of generating tubes, composed of a series of crown pipes, or tubes which spring directly from the bottom manifold or distributor, each one consequently containing water at the temperature of that contained in the bottom manifold; or, in other words, the coolest in the generating system, and, after imparting the usual number of heat units to these tubes, the gases then, of their own accord, were to pass over a new lot of generating tubes which were filled with water at hydrant temperature, it is obvious that, while the first lot of generating tubes cooled the gases considerably, it would be impossible for them, containing hot water, to cool them down sufficiently to decrease the difference in the temperature between the "tail end" gases and the secondary "cool" heating surfaces to very much less than the difference which existed between the gases and the first heating surfaces containing hot water.

This arrangement would, undoubtedly, keep the heat units jumping with alacrity from the gases to the water in the heating surfaces on account of maintaining the wide differences in temperature between the two.

To be sure it is impossible to continue maintaining the actual temperature of your gases, as they pass over the heating surfaces, but it is possible in designing a boiler to keep reducing the temperatures of the various stages of heating surfaces nearly as rapidly as the heat units are absorbed from the gases.

Now, inasmuch as we are basing our thoughts upon supposition, we may as well consider the advisability of injecting more heat units into the steam, after it is made, as another step in the process. Considering that light, heat and power are synonymous, it would strike me that, increasing the temperature of the steam would be almost like increasing the pressure, especially as cylinder condensation has demanded more or less consideration for a number of years.

Now, consequently, it would seem that a water tube boiler, having its heating surfaces sub-divided into the main generating system, then into a primary generating system, above or beyond the main generating surfaces, where the gases of combustion contact secondarily, and then, after the steam is made, passing it through a steam heating system where additional heat is forced into the steam down along side of the furnace, by using the radiated heat, or the heat which escapes in that direction after passing through the generating system of the first stage, would be the one most desired.

While we have been running along on supposition, there is a boiler in fact which has been obtainable for many years, based upon the above principles in design and construction. It is doubtful whether the above principles have occurred to many people, even in the marine engineering world, and it is therefore desirous to call them to their attention with all earnestness, especially when there is a large demand for just such a boiler.

It is shown in one of the issues of the Journal of American Society of Naval Engineers that a battery of Normand boilers, which were designed to produce 23,000 I. H. P., and on an official trial trip fell a little short of the requirements while burning something over 30 lbs. of coal per square foot of grate, weighed nearly 800 tons, while from data which I have at hand, it is a fact that a battery of boilers, designed as described in the foregoing, consisting of twenty-four units, would be able to develop 23,000 H. P. while burning 30 lbs. of coal per square foot of grate, and would weigh not to exceed 300 tons, including boiler foundations, ashpans, breeching and fixtures, and would occupy a floor space of only 2,000 square feet.

Units of the size which would compose such a battery, would not exceed 8 ft. in height from the bottom of the ashpan to the top of the jacket.

I trust that the importance of these statements and comparisons will be apparent to all who may read this article, and that they will thoroughly digest the meaning of the above figures when compared with what has been accomplished or what can be accomplished by the general run of boilers.

Such a boiler, as described in the foregoing, and which is capable of accomplishing the results last stated, is manufactured by the Roberts Safety Water Tube Boiler Company.

The economy of such a boiler and the proof of the foregoing argument, to the effect that an excessive ratio of heating surface to grate surface is not absolutely essential, where the former is correctly arranged with due regard to the varying temperature of the gases and heating surfaces, is furnished by the fact that such boilers actually show a temperature at the base of the stack, under natural draft conditions, of 100 degress Fahr. less than the temperature of the steam due to the pressure on the boiler.

SUPERIOR IRON WORKS DECK ENGINE.

The Superior Iron Works, Superior, Wis., are makers of a deck engine which is in use on some of the largest lake dredges and also on the Atlantic coast. This machine has proved its value especially in the saving of a large item of expense for lines, wire lines being used instead of manila. The company is also building a special steam winding apparatus for raising the hopper doors of dump scows. This has been in use for several seasons on the largest dump scows and effects a material saving of time in winding up the doors of a scow. This apparatus is installed on the 1,000 yard scow built during the past summer by the Manitowoc Dry Dock Co., which was illustrated in the MARINE REVIEW of Nov. 23.

The Detroit, Belle Isle & Windsor Ferry Co. has sent the specifications for its new passenger steamer to the ship builders. The new steamer will be somewhat shorter than the Columbia.

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RIVERS AND HARBORS CONGRESS.

The National Rivers and Harbors Congress will meet in Washington on Jan. 15. This organization is the outgrowth of an appreciation of the value of the inland waterways and harbors of the United States, not only as furnishing a cheap and safe means of transportation but also acting as a great leveler of rates. No avenue of transportation can be improved without bestowing a benefit upon the whole community. Transportation has a wonderfully civilizing influence since it brings all parts of the country closely together and permits the interchange of peoples and commodities. The National Rivers and Harbors Congress is not a local body, but proposes to do for the entire country what the Upper Mississippi Valley Improvement Association, the Tennessee River Improvement Association, and the Ohio Valley Improvement Association are endeavoring to do for local sections. An effort is being made to have a very representative gathering of prominent men in Washington during the sessions of the National Rivers and Harbors Congress. It is hoped that the manufacturing and industrial interests will be well represented, for the improvement of our internal waterways is one of the great commercial needs of the country.

AMERICA'S GREAT WORKSHOP.

An inspection of the present issue of the MARINE REVIEW will show it to be full of information of an exceedingly important character, especially in reference to the great lakes. The great lakes trade is singular in that if it is not moved by vessels it is not to be moved at all. It exists in such enormous volume that the railways would be utterly unable to handle it. It is exclusively a commerce which must be transferred in large units. So sure are the vessel owners of their trade that the opening of the lake season is a matter of indifference to them. They know that their trade will wait until the season does open. That is probably not true of any other business in the world. If a consumer cannot get an article at one store he will go to another for it; if he cannot ship an article by one railway he will send it by another; but iron ore in the Lake Superior country must come down in ships. Early last summer certain sagacious vessel owners began to place orders with lake ship yards for ships for 1906 delivery, very much to everyone's surprise. Orders for ships for next year's delivery are not, as a rule, placed until late in the fall when some idea may be had of what next year's business is going to be. But those that ordered early were wise, for it was not long before orders began to be given profusely to lake ship builders, until, when the year closed, they had on their books orders for thirty-nine steamers, of which thirty-four are freighters for the ore trade. It is interesting to note that with the exception of two ships all these steamers are of the most modern type, having a carrying capacity of from 8,000 to 12,000 tons on a single trip. These thirty-four ships can carry 338,000 tons of ore on a single trip, or in an average season of twenty trips, 6,760,000 tons of ore. This is more ore than was brought down the lake altogether a dozen years ago. There is always talk of much vessel tonnage on the lakes; but it is too doubtful if there is too much vessel tonnage. More ships could be used than were available in the season just closed and if signs count for anything the trade of the great lakes will be greater during the coming season than it was last. The great lakes region is the workshop of the United States.

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RESIGNATION OF MR. HENRY PENTON.

Mr. Henry Penton has resigned from the position of chief engineer of the Great Lakes Engineering Works, Detroit, and the engineering department will hereafter be in charge of Mr. A. George Mattsson, who has been assistant to Mr. Penton since last spring. Mr. Penton needs no introduction to marine men, either on the lakes or on the Atlantic coast, many of the best lake steamers and a number of seagoing ships having received their equipment from his hands. It was, in a measure, through his instrumentality that the Great Lakes Engineering

MR. HENRY PENTON.

Works added a ship building department to its present plant. Mr. Penton was responsible not only for the engineering and designing, but for the construction, installation, maintenance and operation of the electrical and mechanical equipment of the company's three plants, a labor which caused his physical breakdown in October last from overwork. Since then he has taken no active part in the business and following shortly upon his resignation will, with Mrs. Penton, take an extended Atlantic coast and gulf trip. Among the recent ships whose machinery was designed and built under his supervision are the car ferry Detroit and the bulk freighters James E. Davidson, Hoover & Mason, Superior, Peter White, Wm. G. Mather, Delaware, George H. Russel, Frank J. Hecker, Frank C. Ball and B. F. Jones.

A new position has been created, that of engine works superintendent, which will be filled by Mr. George Henderson, lately with the Detroit Ship Building Co.

Mr. Mattsson has been well known to the lake marine for many years as a successful engineer. He was associated for about thirteen years with the old firm of Hodge & Co., to whom the Great Lakes Co. are successors, and about eight years with the Detroit Ship Building Co., during which period he designed the machinery for some of the best passenger and freight steamers on the lakes, among them the Eastern States, Western States and Tashmoo.

BAY CITY PLANT WILL BE IMMEDIATELY REBUILT.

The Bay City plant of the American Ship Building Co. was seriously damaged by fire on Saturday night last, but with characteristic promptitude the company has already begun its resurrection. It will be reconstructed upon a larger scale than ever. President James C. Wallace, General Manager Robert Logan and General Superintendent Frank Jeffrey immediately visited the plant and directed the work of clearing up preparatory to rebuilding. Contracts were let to local builders for the erection of the new buildings and the work will be pushed with the utmost expedition. New machinery will be installed as rapidly as it can be secured. Offers of assistance to the company were many. Capt. Jas. Davidson tendering the use of his ship building plant and the Valley Wind Engine & Iron Co. offering the use of its plant for such work as might be done in it. Arrangements were made with the Bay City Traction & Electric Co. for temporary power and machinery. There will be practically no delay in new construction work under way at this yard.

STEEL CORPORATION CHARTERS TONNAGE.

The Steel Corporation parceled out among the vessel owners during the present week about 5,000,000 tons of ore. This is not quite as much as the vessel owners expected, but it is probable that additional chartering will be done by the Steel Corporation later. If it does not, the movement of wild ore next season will be quite heavy, as the Steel Corporation is not likely to move less ore this year than last. The fleet of the Steel Corporation next season will be able to move between 10,000,000 and 11,000,000 tons, but it would not be surprising if the corporation's total movement of ore reached 20,000,000 tons. Nothing has been done as yet on coal rates and nothing will be done for some time.

NEW ORE DOCK AT MARQUETTE.

Marquette, Jan. 1.—Next week the operations of M. J. Peppard, contractor on the new ore pier of the Duluth, South Shore & Atlantic road, will be increased to more than 2,500 men. The concrete approaches across the South Shore depot grounds and over the streets have been completed, and a few of the piles have been driven. There are 4,500 more to drive and three large machines will begin work at once. Immediately behind these the carpenters will raise the timber bents of the lower story of the dock. All the pile driving is by the Duluth firm of E. T. Williams & Son. Washington timber is arriving at the rate of 500,000 feet per day, and there are now on hand more than 2,500,000 feet. In all about 6,000,000 feet of fir and pine will be used in the dock. It is proposed that the structure shall be ready by the opening of navigation, but the general supposition is that it will be June before it can be used.

Marquette shows a gain of marine business this year of more than 50 per cent, the number of vessel arrivals being 396, against 254 last year. The port is not noted as a large cargo point, for the Duluth, South Shore & Atlantic docks have not been prepared to handle any other than the smaller ships in the ore trade, but the Tomlinson steamer Sylvania took out 8,998 gross tons of ore during August, from the Presque Isle dock of the Lake Superior & Ishpeming railway. The latest departure of the year was the Choctaw, Dec. 5.

The steamer Wm. E. Corey is in worse shape than was expected. About 225 plates will have to come off.

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LAUNCH OF STEAMER B. F. JONES.

MISS ADELAIDE DALZELL JONES.

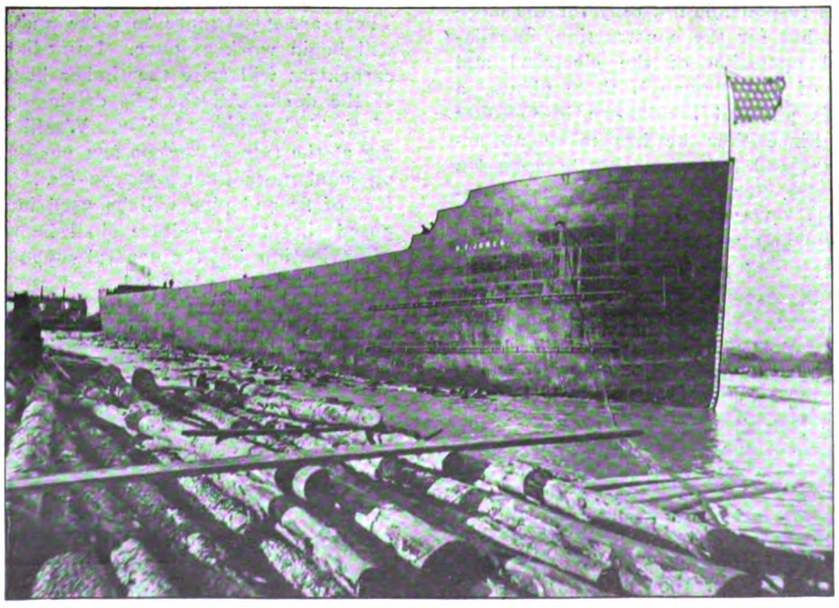
The new steel coarse freight carrier B. F. Jones, building for the Jones & Laughlin Steel Co., at the Ecorse, Mich., plant of the Great Lakes Engineering Works, of Detroit, was successfully launched last Saturday afternoon and will be ready to go into commission at the opening of navigation next spring. The new boat is a modern carrier in every respect, and will have a carrying capacity of 10,000 tons.

The launch of this magnificent ship was in no way different from the launch of scores of other ships which have been dropped into the water within the past two years. It was but a duplication of all that have gone before and those that are to follow, looking from a ship building standpoint, but unusual interest centers in this ship inasmuch as it is a forerunner of a new condition on the lakes, i. e., the ownership by owners of iron ore properties of their own transportation facilities from the deposits along the shores of Lake Superior, to lake ports nearest the furnaces. So rapid has been the progress and development of the iron and steel industries that in the interest of economy the leading manufacturers and owners of these vast enterprises have reached that stage where they can no longer be dependent upon outside interests for their supply of raw material. While for many years the Steel Corporation and several independents have been engaged in the vessel business, this plan is becoming more popular and the lake ship builders now have contracts for the construction of coarse freight carriers for ore consuming companies. The Jones & Laughlin Steel Co., which is one of the largest manufacturers of iron and steel in the world, has owned one steamer, the Angeline, but the great bulk of its ore from the Lake Superior district has been carried by outside tonnage on long term contracts.

The steamer B. F. Jones, launched at Ecorse Saturday, is the first of two 10,000 ton ships now under course of construction for this company, by the Great Lakes Engineering Works.

In his special car Magnet, Mr. B. F. Jones, Mr. Willis L. King, Mrs. B. F. Jones, Mrs. Willis L. King, Miss Adelaide Dalzell Jones, B. F. Jones, 3d., and Master Gordon King, went from Pittsburg to Detroit to attend the launching. Miss Adelaide Dalzell Jones, daughter of B. F. Jones, was sponsor for the ship, which has been name in honor of the late B. F. Jones, father of the present head of the Jones & Laughlin Steel Co.

MRS. W. L. KING, MR. B. F. JONES, MISS ADELAIDE DALZELL JONES, MR. ANTONIO C. PESSANO, MASTER GORDON KING, MR. WILLIS L. KING, MRS. B. F. JONES AND MR. B. F. JONES 3D.



THE B. F. JONES IMMEDIATELY AFTER LAUNCHING.

The great ship, typical of the interests she will represent, great in proportion and the acme of solidity, left the launching ways amid the shriek of the shipyard whistles and cheering of the crowd, and struck the water evenly, sending a gigantic wave across the marshes and then gradually straightened up on an even keel and majestically rode the waters of the launching slip.

The steamer is 550 ft. long, over all, 530 ft. keel, 56 ft. beam, and 31 ft. deep. She will be provided with a triple expansion engine with cylinder dimensions 23, 37, 63 by 42-in. stroke, steam being furnished by two Scotch boilers 15 ft. in diameter by 11½ ft. long, with a working pressure of 175 lb. to the sq. in. The boat has thirty-two hatches, spaced

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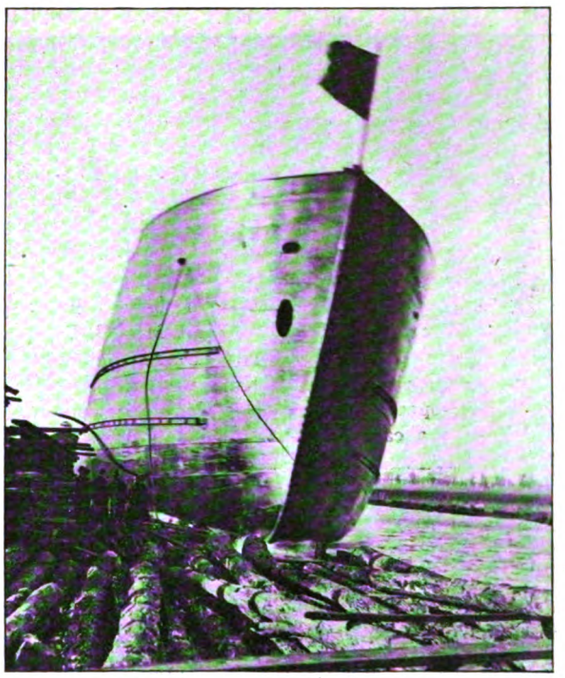
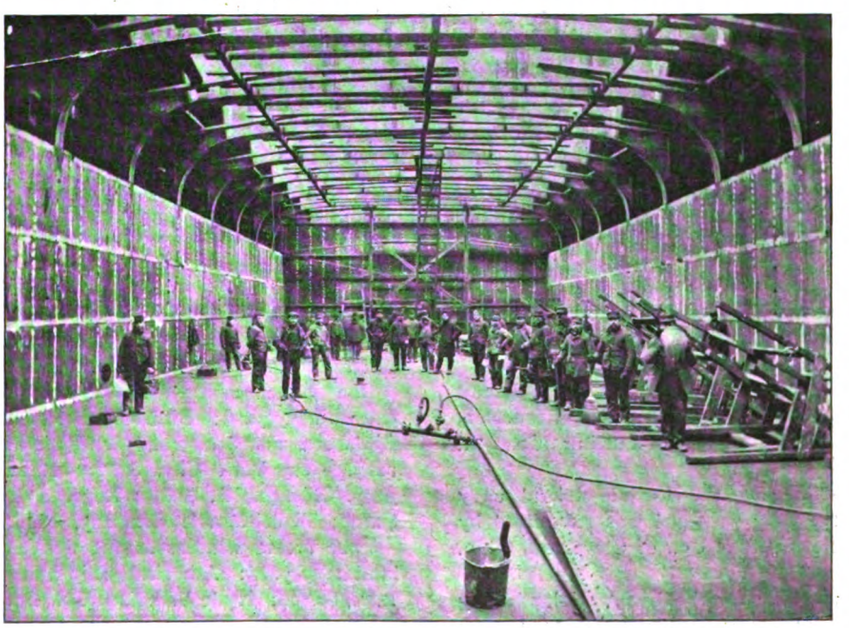
12 ft. centers. The interior construction is of the straight tank side, arch type after the most approved modern plans.

After the launch the Pittsburg party and the ship building officials with a few guests were tendered an informal dinner at the Detroit club. President Antonio C. Pessano presided. Short addresses were made by Mr. B. F. Jones, Mr. Willis L. King, Mr. F. W. Whiting and Mr. Walter S. Russel. Miss Adelaide Jones, who is only nine years of age, is the youngest miss who has christened a boat for the Great Lakes Works. Therefore when Mr. Pessano proposed a toast to her it was drunk standing, and replied to by her father, Mr. B. F. Jones, who complimented the builders on the magnificent showing they have made, and also on the fine appearance of the ship. Mr. Willis L. King in his remarks, referred to the unprecedented volume of business during the past year, and that which is now in sight for the next two years. Mr. Whiting's remarks were of a jovial nature, and Mr. Walter Russel gave a recitation in the French-Canadian dialect of Drummond's poem "Johnnie Corteau," which was most enthusiastically received, Mr. Russel being perfectly at home in this dialect. The same evening Mr. Jones and his party returned to Pittsburg.



THE B. F. JONES TAKING THE WATER.

The launching party at the ship yard included Mr. and Mrs. B. F. Jones, Miss Adelaide Dalzell Jones, Master B. F. Jones 3d, Mr. and Mrs. Willis L. King Jr., and Master Gordon King, all of Pittsburg; C. D. Wetherbee, general superintentendent Bath Iron Works, Bath, Me.; F. A. Goodrich, St. Louis, Mo.; Mr. Dunbar, Durango, Col.; Mr. and Mrs. F. H. Holt, Mrs. Antonio C. Pessano, Miss Elizabeth Pessano, Miss Anne Russel, Mrs. W. P. Hamilton, R. E. Plumb, W. S. Kinnear, Congressman Edwin Denby, Mr. Conahan, Walter Russel, Antonio C. Pessano and John R. Russel.



INTERIOR VIEW OF THE STEAMER B. F. JONES.

NEW AIDS TO NAVIGATION.

The annual report of the lighthouse board for the fiscal year ended June 30 last, contains a recommendation for building a new keeper's dwelling at Windmill point, Detroit river, at a cost of $5,000. It also asks for $18,000 to establish additional lights on the Isle Aux Peches range, to mark the 20 ft. channel in Lake St. Clair, saying: "The fact that the piles on which these lights stand are always carried away by ice in winter and run over by steamers in summer shows the need of structures of strength and permanence which will serve as day beacons as well as night lights."

A keeper's dwelling at Tawas, Lake Huron, is necessary, the report states, costing $5,000. The report states that a large amount of construction and repair work was carried on during the year at stations on St. Clair river, Fort Gratiot, Harbor Beach main, Saginaw river range, Thunder Bay island, Middle island, Presque isle, Forty-Mile point, Spectacle reef, Detour, St. Mary's river and a great many other points on Lake Huron, Michigan and Superior.

A keeper's dwelling at Grand Marais range light, Lake Superior, is recommended to cost $5,000; range lights in Grand island harbor, costing $13,200; fog signal at Portage river pier head, costing $22,000; a lighthouse at Eagle Harbor costing $38,000.

A lighthouse worth $55,000 is urged for Portage lake ship canals pierhead at the end of the breakwater, and for lights on Menagerie island $21,000 is asked. Concerning a light vessel for Martin's reef, the report says: "It is believed that it would be economical to build this of steel, with auxiliary steam power, as she could then not only place and maintain herself on her station, but she could also tow the Poe Reef light vessel to and from her station, and thus effect a saving of about $150 a year. It is estimated that a suitable steam light vessel for Martin's reef, with auxiliary steam power, can be built for $35,000.

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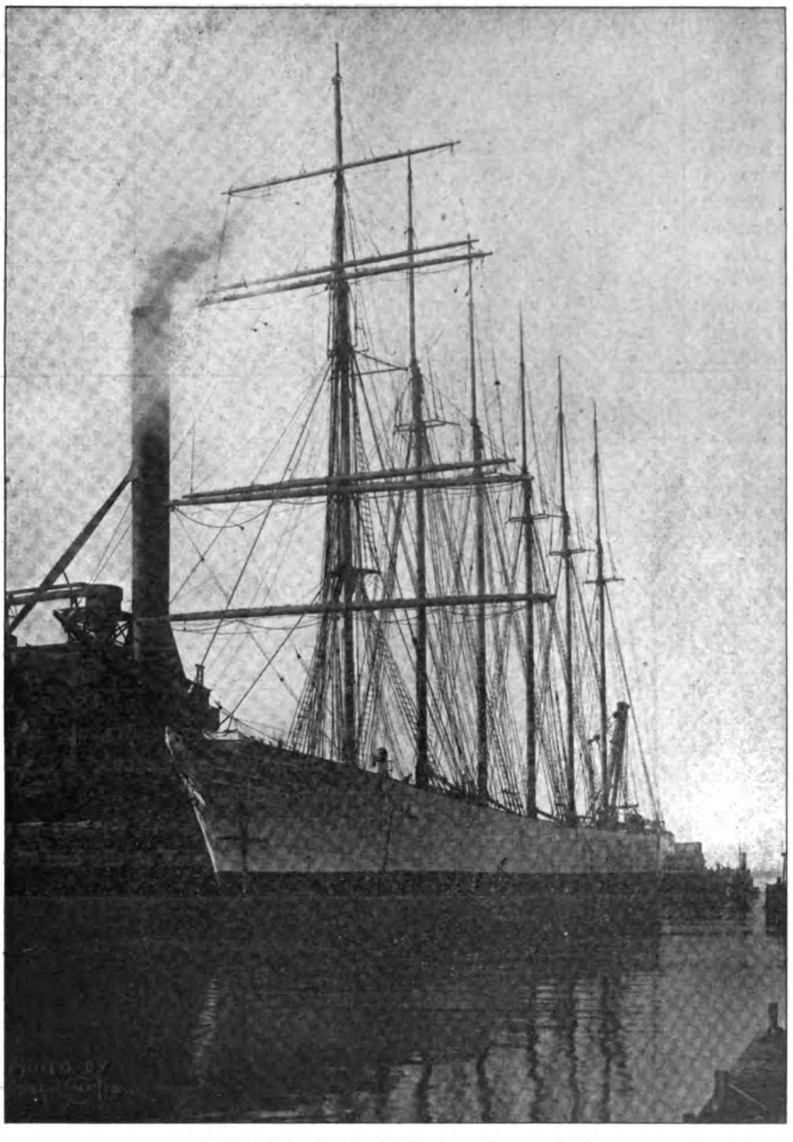
REBUILDING A BARKENTINE.

The Moran Bros. Co., of Seattle, Wash., have just completed the rebuilding, remasting and rigging of the six-masted barkentine Everett G. Griggs. his vessel was originally an English four-masted barkentine, afterwards being registered as a German vessel. She was known under the British flag as Lord Wolsely and under the German flag as Columbia. While bound for Puget Sound in 1902 she was dismasted in straits of Juan de Fuca in heavy water and docked at the harbor of Esquimaux. After survey she was abandoned and sold by the underwriters, being later purchased by the Alaska Steamship Co., of Seattle, and taken to the plant of the Moran Bros. Co. for alterations and repairing.



SIX-MASTER BARKENTINE EVERETT G. GRIGGS.

BIDS FOR MACHINE TOOLS.

Washington, Dec. 30.—Bids were opened at the Bureau of Supplies and Accounts of the navy department, this week, for a number of important classes of supplies and equipment.

The items and proposals received were as follows: Two reversible wood boring machines for use at the Mare Island navy yard, Cal. Chicago Pneumatic Tool Co., Chicago, Ill., $165; Harron, Rickard & McCone, San Francisco, Cal., $160; The Ingersoll-Rand Co., New York, $140; Independent Pneumatic Tool Co., Chicago, $150; Tatum & Bowen, San Francisco, $180.

One combined hand punch and shear for Mare Island navy yard, Harron, Rickard & McCone, San Francisco, Cal., $58; The Handlan-Buck Manufacturing Co., St. Louis, Mo., $135.

For one screw machine for the League Island navy yard at Philadelphia, the only proposal was submitted by the Cleveland Automatic Machine Co., of Cleveland, Ohio, which bid $1,050.

One metal planing machine for the League Island navy yard, Philadelphia, Pa. Manning, Maxwell & Moore, New York City, $3,000; The Niles-Bement-Pond Co., New York City, $2,955; Royce & Ricketts, Washington, D. C., $2,855; The Vandyck-Churchill Co., New York City, $2,625.

One cold saw cutting off machine to be delivered at the League Island navy yard. J. W. Cregar Agency, Philadelphia, Pa., $1,300; Railway Appliances Co., Chicago, Ill., $740; Vandyck-Churchill Co., New York City, $880.

One engine lathe for the League Island navy yard. J. W. Cregar Agency, Philadelphia, Pa., $1,800; The Niles-Bement-Pond Co., New York City, $1,793; Royce & Ricketts, Washington, D. C., $1,800; The Vandyck-Churchill Co., New York City, $1,790.

One single frame steam hammer for the League Island navy yard: Alliance Machine Co., Alliance, Ohio, $920; Drew Machinery Agency, Manchester, N. H., $742; R. W. Geldart, New York, $1,350; Handlan-Buck Manufacturing Co., St. Louis, Mo., $744; Manning, Maxwell & Moore, New York City, $900; Morgan Engineering Co., Alliance, Ohio, $975; Niles-Bement-Pond Co., $795; Royce & Ricketts, Washington, D. C., $745; Vandyck-Churchill Company, New York City, $819; Vermilye & Powers, New York City, $745.

One portable boring bar for League Island navy yard: Drew Machinery Agency, Manchester, N. H., $474; Handlan-Buck Manufacturing Co., St. Louis, Mo., $495; H. B. Underwood Company, Philadelphia, Pa., $498.

One 38-inch band saw for the Norfolk, Va., navy yard: J. W. Cregar Agency, Philadelphia, Pa., $350; Oliver Machinery Company, Grand Rapids, Mich., $705; Smith-Courtney Company, Richmond, Va., $705.

One 40-inch motor driven metal sawing machine for an eastern navy yard: Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., $3,133 and $2,185; Niles-Bement-Pond Company, New York City, $2,260; Railway Appliances Company, Chicago, Ill., $1,859; Royce & Ricketts, Wash., D. C., $2,100; Tindel-Morris Company, Philadelphia, Pa., $3,300.

Four steam windlasses for delivery at the League Island navy yard: American Ship Windlass Co., Providence, R. I., $2,100; Hyde Windlass Co., Bath, Me., $2,100.

For converting a square shaft 40-ton traveling crane at the New York navy yard into an electric traveling crane of the same capacity: Alliance Machine Co., Alliance, Ohio, $6,800; Case Manufacturing Co., Columbus Ohio, $5,400; Manning, Maxwell & Moore, New York City, $5,190; Morgan Engineering Co., Alliance, Ohio, $6,365.

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TOWING RAFTS WITH CHASE MACHINES.

A good deal of comment has been in the marine papers recently upon the breaking up of a huge log raft that had been towed to San Francisco by the Hammond Lumber Co.'s steamer Francis H. Leggett and which is reported as having gone to pieces in San Francisco bay, making a serious menace to shipping. By prompt action and the aid of several tugs, the logs appear to have been picked up and safely secured before any damage resulted. It is feared that some day one of these rafts will break loose or break up at sea, where the huge logs, floating low in the water and drifting far and wide may cause shipwreck and disaster. Governmental action is suggested to stop the practice.

Rumors are current that our neighbors across the line are contemplating the towing of similar immense timber rafts from British Columbia ports to the Orient, and the name of Mr. R. W. Dunsmuir has been rumored in this connection. Some credence is lent to this story by the fact that Mr. Dunsmuir is building a large steamer in Victoria, and has ordered a large Chase automatic steam towing machine installed.

It is evident that no action by the United States government alone could forestall or prevent the towing of these rafts nor have the writers referred to altogether made out their case. The steamer Leggett has been towing these rafts for several years from Stella, Wash., to San Francisco, without accident. They have been towed across the Columbia river bar and down the western coast with entire security, the rafts comprising over ten million feet of timber each. They are built up strongly by great chains, and towed with two and one-eighth inch diameter steel cable, handled by a Chase automatic towing machine. The accident described occurred after the raft had been turned over to harbor tugs by the Leggett, which proceeded further down the coast with her cargo.

If there is any lesson to be learned from the breaking up of the San Francisco raft, it would seem to be that ordinary harbor tugs, not equipped with automatic towing machines, cannot safely be intrusted with their care, and government regulations are certainly in order to compel the installation of adequate apparatus on any tug boats undertaking to tow these rafts, even in sheltered waters.

The Standard Oil steamer City of Everett, towing a big steel oil barge was recently caught in a severe storm off Cape Hatteras and so badly stove up by the seas that the wireless telegraphy was brought into play and the steamer Lucas sent from New York to stand by to windward and by the spreading of a little Standard oil on the waters kept the seas from breaking until the storm subsided. The barge, towed by a Chase automatic machine appears to have been at no time in danger.

In the same storm the barge Saxon, while off Cape Hatteras, broke loose from the steamer Aragon, which had her in tow, and the Norwegian steamer Gyller, towing the Pennsylvania Steel Co. barge Steelton also parted her hawser and the barge went adrift. Neither the Aragon nor the Gyller has automatic towing machinery.

SEIDLER-MINER ELECTRIC CO.

The Seidler-Miner Electric Co., 207-211 Jefferson avenue, Detroit, are making a specialty of the electric lighting of ships. Being not only extensive dealers in electrical supplies but the manufacturers as well of marine electrical equipment, and contracting electrical engineers, they are enabled not only to quote low prices but to make prompt shipments. The company is prepared to make complete installations or to reconstruct old ones in a safe, substantial and efficient manner, assuring the highest classification with the Great Lakes Register, Inland Lloyds, Marine Rules (National Code), United States Register or United States Navy. The company has just issued a catalog in which its marine electric fixtures and fittings are given much attention. The company says that vessel owners should guard against the equipment of their boats with the many makeshift devices often substituted by electrical contractors, who in general cannot even duplicate their own devices or that renewals cannot be secured in the open market from regular electric supply houses. The catalog is very thorough and every device is well illustrated. It would be well for anyone desirous of installing an electrical equipment in their boats or making changes in any part of it to write for the catalog.

The catalog also contains the National Electric Code rules and requirements for the installation, wiring and apparatus for marine work; Inland Lloyds rules governing the electrical equipment of vessels; the Great Lakes Register rules for the use and application of electric lights and appliances on board ship; and the rules of the United States Standard Register of Shipping. This information is exceedingly valuable and is convenient to have in so compact a form.

The Seidler-Miner Electric Co. has built up an excellent business along the lakes, due to the thoroughness of its work and the reasonable figure at which it is performed.

TAYLOR WATER TUBE BOILERS.

The Taylor Water Tube Boiler Co., Detroit, Mich., supplied the following steamers with their boilers during the past year.

Steamer Burton, 102 ft. x 18 ft. x 5 ft. 6 in. A. M. Hunt, Tacoma, Wash., 10-22 by 14; boiler 7 ft. x 8 ft.

Steamer Shamrock, 86 ft. x 17 ft. x 6 ft., John Pickernell, Astoria, Ore., 9-21 by 12, boiler 6 ft. 6 in. by 7 ft.

Steamer Zapora, 160 ft. x 24 ft. x 12 ft., International Fisheries Co., Tacoma, Wash., 14-22-36 by 28, two boilers 9 ft. x 9 ft.

Steamer P. J. Thistlewood, 120 ft. x 24 ft. x 5 ft. 6 in., Vinyard Ship Building Co., Milford, Delaware, 11-22 by 14, boiler 6 ft. 6 in. x 7 ft.

Steamer Vashon, 105 ft. x 19 ft. x 5 ft. 6 in., Munson & Wyman, Seattle, Wash., 11-24 by 14, boiler 8 ft. x 9 ft.

Steamer Lieut. Geo. M. Harris, United States war department, 105 ft. x 22 ft. x 10 ft., boiler 8 ft. x 9 ft.

Steamer Snoqualmie Fire Boat, Seattle, Wash., 110 ft. x 24 ft. x 12 ft. Propelling engine 12 and 26 by 16, pumps four cylinders 16 x 10 x 11, two boilers 11 ft. x 9 ft. 6 in.

Steamer Dove, Matthew McDowell, Seattle, Wash., 85 ft. x 16 ft. x 5 ft., engine 10-22 by 12 in., boiler 5 ft. 6 in. x 8 ft. 6 in.

Steamer Mizpah, 75 ft. x 15 ft. x 5 ft., M. W. Jones, Olympia, Wash., 7-14 x 10 in. boiler 5 ft. x 6 ft.

Tug Bermuda, Bermuda Steamship Co., Vancouver, B. C., 86 ft. x 17 ft. 6 in. x 9 ft., engine 9-20 by 12 in., boiler 6 ft. by 7 ft. 6 in.

Stern wheel steamer building at the Atlantic Works, East Boston, for the Eastern Steamship Co., engines 16 x 72; condensing boilers two 7 ft. 6 in. x 8 ft. 6 in.

Four government launches 60 ft. x 12 ft. x 4 ft. 6 in., built by the New York Shipbuilding Co., engines 6-12 by 10 in., boilers 5 ft. x 5 ft. 6 in.

Yacht Wauneta, the Messrs. G. E. & C. A. Painter, Pittsburg, Pa., 80 ft. x 8 ft. x 3 ft. 6 in., engine 9-14-22 by 9 in., boiler 5 ft. x 6 ft.

Steamer J. O. Watson, 80 ft. x 18 ft. x 2 ft., J. O. Watson, Lock No. 4, Pa., engine pair 8 ft. x 36 ft., boilers 5 ft. x 6 ft.

Also nine boilers for launches for the United States war department.

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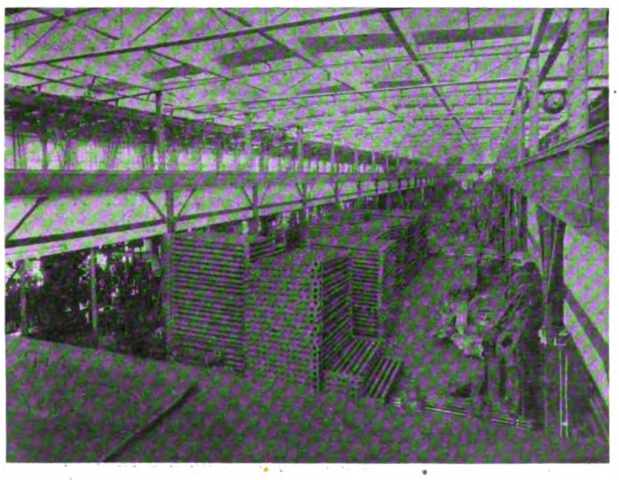
STURTEVANT PLANT AT HYDE PARK.

As the growth and development of the B. F. Sturtevant Co. continued in its plant at Jamaica Plain, Mass., the conclusion was gradually reached that the available facilities in connection with the old location could never meet the requirements of a thoroughly up-to-date manufacturing

YARD AND POWER PLANT FROM TOP OF BLACKSMITH SHOP.

establishment as regards size, arrangement of buildings, and railroad facilities. While negotiations were in progress for the purchase of a new location near Boston the works at Jamaica Plain were visited by a serious fire, April 14, 1901, which destroyed a large amount of valuable machinery and threatened to severely cripple the business. But with restless energy and true American enterprise the business was practically placed upon its feet again within thirty days. When it is considered that within this period a nearly complete equipment of new machine tools had to be secured and put in operation in place of those destroyed, the progressive spirit of this concern is made evident.



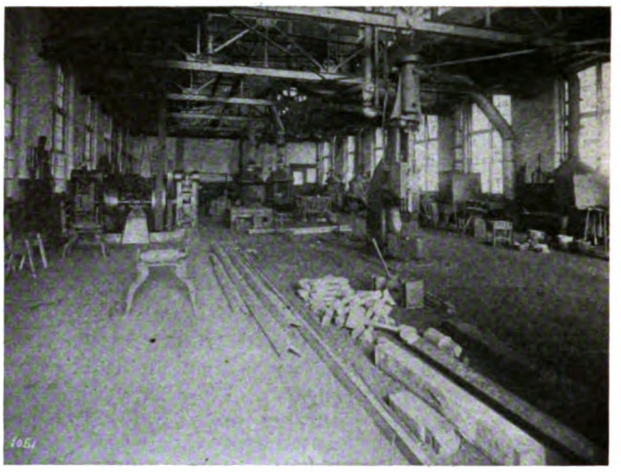
INTERIOR OF MACHINE SHOP LOOKING TOWARD TESTING BUILDING.

This disaster naturally hastened the final acquirement and development of a site for the new plant.

Aside from the general character of the lot itself the principal factors considered in reaching a decision were proximity to raw materials, and to an abundance of skilled labor, adequate shipping facilities, ample water supply, and space for ready disposal of waste material.

The advantages of the West as against the East were carefully weighed, but the company readily expressed its abiding faith in the prosperity of New England, in the facilities which it presents for work of the character conducted by this company, and in the quality of its skilled labor as an offset to somewhat higher rates for raw material.

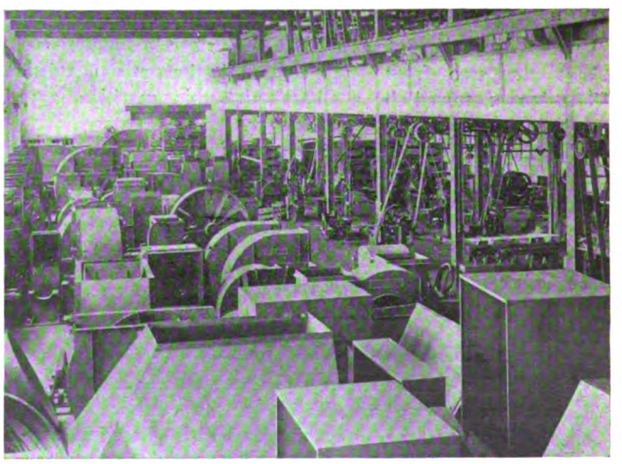
The best combination of advantages was presented by a lot of nearly 20 acres in the town of Hyde Park, Mass., already well known as the home of such industries as the Becker-Brainard Milling Machine Co. and the American Tool & Machine Co., and of the new shops of the N. Y., N. H. & H. R. R. Here was presented a population of parti-



INTERIOR OF FORGE SHOP.

cularly skilled workmen which could readily be supplemented by present employees of the company; the new location being only 6 miles from the old plant. The lot selected has a frontage of about 1,300 feet upon the freight yard of the N. Y., N. H. & H. R. R. at Readville Station, the distributing point for all freight passing over either the Midland or Providence divisions of said road. One side of the lot is bounded by a plentiful stream and the adjacent shore is at a level of more than 10 feet below that of the yard and buildings, thus providing sufficient space for dumping waste material for years to come.

The site having been selected, most careful consideration was given to the size and character of the buildings; the



ERECTING FLOOR FOR FANS AND HEATER JACKETS IN FAN BUILDING.

head of each department was consulted, his recommendations reduced to writing and frequent conferences held as to the requirements of the individual departments. With these data at hand the individual and aggregate areas

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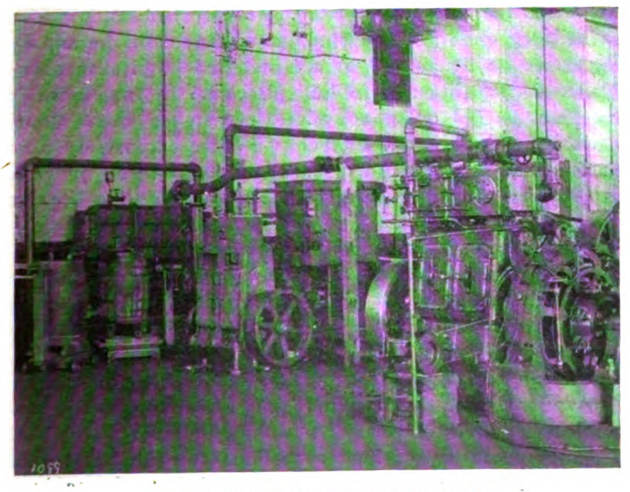
were determined and the plans started with the idea of providing a total floor space slightly more than double that of the old plant. The aggregate floor area of the finished buildings is actually over nine acres or nearly two and one half times that of the Jamaica Plain plant. Employment is already given to about 1,300 hands although the plant will accommodate nearly 2,000. A special train which runs directly into the yard naturally assists in transportation.

The disposition of the buildings was determined by the

TESTING ELECTRICAL FANS IN ELECTRICAL DEPARTMENT.

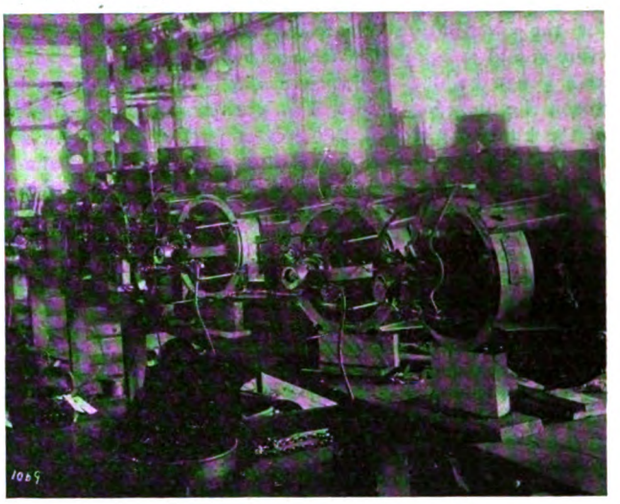
provision to be made for growth. The adopted arrangement provides for a group of buildings parallel to the railroad tracks with accomodations for spur tracks between buildings, their entrance at the ends of certain buildings and an opportunity for growth of all important structures by extension in length. The type of construction is somewhat composite in its character consisting of steel interior columns and main steel girders, with heavy brick walls, wood timbered floors and plank roofs. In the case of the one story foundry, the roof is supported by steel



TESTING PLATE IN TESTING BUILDING.

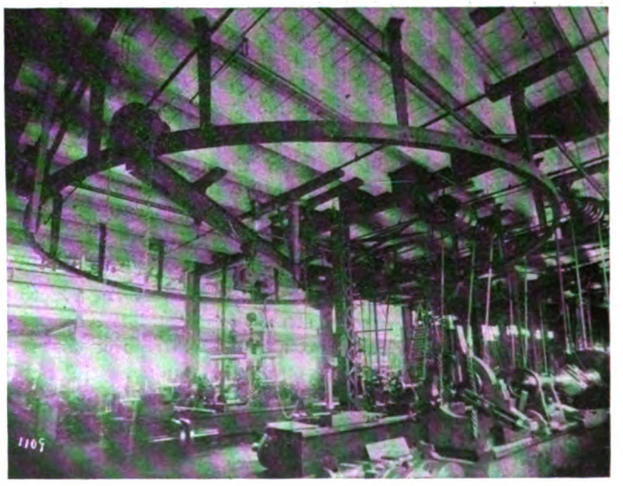
trusses, in the other buildings open timbering with wooden columns in the upper floor is employed. The main floors in the machine, fan and erecting shops are of tar concrete upon which 3-inch hemlock is bedded in liquid pitch and toenailed together. The upper floors are carried upon hard pine beams on 4-foot centres spanning the spaces between the steel girders, which follow a unit system of 20 feet on centres throughout the buildings. The machine shop gallery floors which are designed for 250 lbs. load per square foot, are of 2½-inch plank; other upper floors are 2-inch plank for 200 pounds per square foot. Maple top flooring is used in all cases. All roofs are of 3-inch plank with tar and gravel top.

The entire plant is electrically driven and lighted at 220 volts from a central power house containing at present one 100 K. W. and one 250 K. W. Sturtevant Generating Set; the power plant engines run condensing, the exhaust steam



TESTING ELECTRICAL FANS.

derived from engines under test upon the plate in the testing building is utilized for heating; supplementary live steam being admitted at reduced pressure as may be required. Waste exhaust is discharged through a Sturtevant exhaust head. The boilers are equipped with Sturtevant fuel economizer for heating the feed water. The power house is placed sufficiently far from the ends of the buildings to permit of ample extension of each, and near enough to the water supply to reduce to a minimum the expense of conveying condensing and other water. Steam,



ROUND JIB CRANE, MACHINE SHOP.

electricity and compressed air are transmitted to the individual buildings through a concrete tunnel and a supplementary system of covered trenches.

Foundations for many of the buildings were put in during the late fall of 1901. Actual work of construction upon the foundry and pattern buildings began in July 1902, and the first heat was poured on December 29, 1902.

The pattern building provides at one end a two story

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portion 80 feet square for carpenters, flask makers and metal makers on the first floor, and for regular pattern makers upon the second floor. The balance of the building which is devoted to pattern storage is of about the same ground area and is provided with intermediate floors making four in all separated from the other portion of the building by double fire walls and automatic fire closing doors. The close proximity of this building to the foundry facilitates rapid intercourse.

The foundry, 170 x 350 feet in dimensions is designed for the distribution of molten iron upon a floor track system, and is equipped with narrow gauge railways of 24-inch gauge bedded in concrete which form runaways between the moulding floors. Two craneways run lengthwise of the building through the greater part of its length and the tracks extend beneath the crosswise traveling crane in the cleaning room at the end of the building. The brass foundry is located in one corner, a wash and locker room in the adjacent corner and the core room between the two. Storage for supplies is provided upon one side adjacent to the railroad switch. From the bins thus provided, the iron and fuel charges already weighed are carried directly to the charging floor.

From the foundry the castings pass to the rear of either the machine shop or the fan shop. The former is of the familiar gallery type, 500 feet long, with wings 40 ft. wide, and central craneway of the same width designed for crane of 20-ton capacity; making a total width of 120 feet. The lighting, which is remarkably effective, is secured principally by a series of sawtooth skylights running crosswise of the roof with glass facing due north. The present crane of only 10 tons capacity serves the entire floor and finally deposits the substantially complete engine or generator upon a transfer car which passes through to the testing building where a 15-ton crane picks up the machine, drops it upon the testing plate and subsequently carries it forward to the steam railway track which passes through the end of the building and provides space for the loading of two cars at a time. The upper floor of this building (which measures 80 feet x 240 feet and is three stories high) together with portions of the adjoining buildings which is devoted to the electrical department and provided with individual small traveling cranes.

Both steam and industrial railway tracks enter the machine shop at the end farthest removed from the erecting shop. Generally speaking large castings and forgings pass in at this end and are transported by the crane, while smaller articles are brought in through numerous side entrances and are handled by hoists or by manual labor. Industrial tracks cross the building at the centre and both ends. The centre cross track is in the direct line of transit from foundry to forge and fan shops.

Upon the ground floor in the corner nearest the erecting shop is located the general stores room and the office of the stores keeper. This room, measuring 40 x 100 feet contains general stores, brass and malleable castings and the like, and is the repository for completed parts of engines between the time of their completion and their requisition for assembling.

Tools are arranged for the progress of the work from the open end of the shop toward the finished stores and erecting shop. Until such time as an independent department is provided for the manufacture of economizers, equipment for this work is provided near the entrance to the machine shop. Otherwise the grouping of machines is in accordance with the general scheme. In the open craneway are already located two Detrick & Harvey open side planers, one a 60-inch and the other a 72-inch, a 6-foot and a 7-foot Baush radial drill, a Beaman & Smith horizontal boring mill with 60-inch swing, and 48-inch Johnson lathe. Immediately beneath one of the side galleries is a line of planers including a Cincinnati 60-in. x 48-in. high, a group of radial drills and several horizontal boring mills; all served by traveling cranes on a continuous runway. Beyond these are the large vertical and planer type milling machines.

Under the opposite gallery are arranged the large vertical boring mills, including a 76-inch Bullard, the large upright drills and a complement of chucking crank shaft and shafting lathes.

The second floor is served by four elevators and an equal number of stairways, one at each end and two at the centre. The galleries are connected at the ends by bridges; the grinding and polishing room (equipped with a Sturtevant exhaust fan, hoods and piping) being located at the end adjacent to the erecting shop. Close beside it on the same floor is the brass finishing department and the office of the superintendent of the machine department. In the opposite gallery in the most accessible position are the tool making and tool storage rooms. An enclosed bridge connects with the second floor of the fan shop.

Machine tools are grouped by types, and so far as possible arranged for progressive operations. Space is left for additions in supplementary parallel rows. Large machines are driven by direct attached Sturtevant motors. Twenty horse-power motors suspended overhead are so located as to drive the small tools in groups of suitable size through individual lengths of line shaft.

The building devoted to the manufacturing of fans, heaters, etc., is 80 feet in width, of the same length as the machine shop and three stories in height, of typical mill construction, provided with all conveniences for handling material and arranged so that goods can be received at, and shipments made from numerous points along one side, while other supplies are brought in from the court between it and the machine shop.

One half of the length of the fan shop is served by a 5-ton traveling crane, the floor to floor height throughout the area being 32 feet to provide for the construction of large steel plate fans for ventilation, mechanical draft and the like. Here also are built the heater jackets, some of them large enough for a summer cottage. In the adjoining space on the first floor are installed large shears and brakes for cutting and folding plates up to 120 inches in length and rolls for ½-inch plates 120 inches wide. Pneumatic punches, riveters and chippers are extensively used in this building. Plate iron is completely stored on edge in diagonal alcoves in the storage shed alongside the fan shop, which has capacity for nearly a thousand tons.

Immediately above the gallery is a supplementary equipment of smaller plate working tools, punches, etc. Upon this floor are built all of the steel plate fan casings for planing mill exhausters, small steam, electric and pulley fans.

Immediately above in the gallery is a suplementary equip- department, near the large five ton elevator which serves all floors. The other end of this floor is devoted solely to the manufacturing of heater sections for the Sturtevant steam hot blast apparatus. Millions of feet of one inch pipe are annually cut up by the numerous machines and made into sections by screwing into cast iron bases. The sections thus made are tested by hydraulic pressure to 180 pounds per square inch.

Immediately above, upon the second floor, the cast iron fans are built; here also are constructed forges, countershafts, etc. All fans except the largest one given a rigid inspection test. Nearly one-half of the third floor is devoted to galvanized iron work, the making of air distributing pipes and shapes, the manufacture of exhaust heads,

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etc. Upon the same floor are set up the fan wheels ranging all the way from 6 inches to 20 feet in diameter. The balance of this floor is devoted to the punching and commutator division of the electrical department, which is located upon the adjoining third floor of the erecting building. In one end of the latter space occupied by this department is the baking-room for armatures, etc. This measures 40 feet square, is entirely fire proof and contains two steam heated ovens. At the other end of the building is the special store room for electrical supplies. The balance of this floor and of the intermediate floor below is devoted to winding, assembling, testing, etc. Fans are here equipped with motors and run under test conditions Generators for direct connection are carried down to the first floor of the same building where they are attached to their respective engines and continuously run upon the test plate. The balance of the first floor is given to the assembling of engines and to the packing, storage and shipment of these machines. The testing plate measuring about 30 feet by 60 feet is completely equipped with steam and electrical connections; engines may be run condensing or noncondensing and efficiency tests conducted. This very complete equipment has proved invaluable in conducting the rigid tests demanded by the U. S. navy department upon the engines, generating sets, engine and motor driven fans, which this company has furnished to the government in large numbers.

The smith shop, 40 feet by 100 feet, serves both fan and machine shop buildings with equal facility, while the wash house and locker room also measuring 40 ft. by 100 feet and two stories in height, is so located as to reduce to a minimum the distance to be traversed by the individual workman. A separate building with concreted basement is provided for a storage of oil, paint, naphtha and the like.

The smith shop is equipped with a full outfit of Sturtevant forges with blower for blast and exhaust for removing smoke. The equipment also includes a Dupont power hammer and an 1,100-pound Bement, Miles & Co.'s steam hammer, together with heavy shears for cutting angles and tees, of which thousands of tons are used annually in the construction of fans and heaters. In the open court room near the smith-shop and between the fan and machine shops is stored under lock and key all of the high grade bar iron and steel, and upon a piling floor and in open racks are kept all of the structural shapes required.

The standard first floor height in the main building is 17 feet, that of the second and third stories is 15 ft. The windows are large and numerous. Ribbed glass is used in all but the lower sashes. All structural steel, window frames, racks, and bins and the walls up to a height of 5 ft. are painted a rich green. The balance of walls and ceilings is covered with white cold water paint.

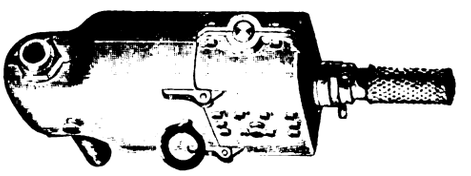
The entire industrial equipment was designed and constructed by the B. F. Sturtevant Co. in the effort to secure something better than the market afforded. The outfit comprises the industrial railway system including the platform, coal, charging and dumpcars, ladle trucks, truck ladles and turn-tables; the general factory equipment consisting of cast iron bench legs, electric hoists, wash-sinks, shelf-brackets for pattern storage, etc., the manhole and catch basin covers and frames, trench cover plates, hangers and the like.

All of the buildings are heated and ventilated by the Sturtevant system. In the machine shop the hot air pipes are hidden beneath the second floor wall benches and deliver most of the air downward to the first floor. The fan and erecting shops are supplied through an underground duct which delivers the hot air to external vertical flues upon one side of the building which in the case of the fan shop are located 40 feet on centers and discharge the air across the building above head level.

The office is a model structure of its kind and serves as headquarters for the entire business. It contains the correspondence, accounting, designing and drafting offices, the production department, the advertising bureau, and a printing office and lunch room in the basement. It is four stories in height.

REVERSIBLE PNEUMATIC MOTOR

Herewith is illustrated a reversible pneumatic motor with which may be operated different kinds of tools used in the construction of ships, boilers, bridges, engines and other machinery. It possesses many new features which render it very desirable for manufacturers of this class of work. As will be seen, the spindle is through the extreme end so it can be operated in very close quarters. The casing has a hinged lid by raising which the machinery may be readily inspected and oiled, which latter insures durability. The motor has two oscillating cylinders made of bronze brass, taking air at both ends, and the admission and exhaust are controlled by the oscillation. The trunnions have steel ferrules to protect them from wear. In the main frame there are two air chests (one on each side), one for live air, the other for exhaust, and by turning the handle half way around, the functions of these chests become reversed, thereby reversing the motion and readily controlling the same. By a ¼ turn of handle it stops. The air is admitted and exhausted through the handle which also has an adjustable collar which can be set so that the motor runs but one way only. It has a detachable handle which is used when the drill is suspended or when used for tapping and reaming.



The largest motor of this type weighs 35 lbs. and develops about 20 H. P. under 90 lb. pressure, consuming about 17 cubic ft. of free air per minute. The maximum speed of the drill spindle in this size is about 200 revolutions per minute under 100 lb. pressure. The speed can be controlled by the handle or throttle to suit requirements.

This motor can be used in locomotive fire boxes to expand all the flues in the sheet with self-feeding expanders, drilling door sheets, and holes in flanges of I-beams by setting point of feed sleeve against one flange and the drill in the other. It has very few parts; is very compact and powerful. This motor is patented and manufactured by the Helwig Mfg. Co., St. Paul, Minn.

WEBB PERFECTION TYPE OF GALLEY RANGE.

Elisha Webb & Son, Philadelphia, Pa., makers of the "Web perfection" type of galley range advise the MARINE REVIEW that the year just closed has been one of their most successful. The importance of the circulating system used in connection with their ranges is being appreciated, as is attested to by the many installations they have made during the past year, in practically all classes of vessels; a few of which were the schooner yachts Elmina II, Shepherdess, steam yacht Albatross, Arctic steamer Roosevelt, Light Vessel No. 52, lighthouse tender Maple, Venezuelan gunboat Restaurador, steamship Persian and City Ice Boat John Weaver. Particulars of the range and system will be furnished upon application.

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IRON ORE ON LAKE ERIE DOCKS.

The figures compiled from the returns sent in by the various dock companies show that iron ore receipts at Lake Erie ports during the season of 1905 were 28,479,056 tons. Out of the total movement of ore by lake of 33,476,904 tons on Dec. 1, Lake Erie docks hold a balance of 6,438,967 tons. During 1904 the total output by lake was 21,226,591 of which Lake Erie docks received 17,932,814 tons and held a balance on dock Dec. 1 of 5,763,399 tons. In 1903 they received a balance of 19,681,731 tons and held a balance on dock Dec. 1 of that year of 6,371,085 tons. While practically 10,000,000 more tons were received at Lake Erie docks during 1905 than were received during 1904, the docks held less than 1,000,000 tons more than they did in 1904, showing a proportionately greater movement from vessels to cars. In fact, 80 percent of the ore was handled direct, not touching the dock at all. The reserve of 6,438,967 tons on Lake Erie docks Dec. 1 is ample. Never in the history of the trade has so large an amount as 5,000,000 tons gone forward from dock to furnaces during the winter season, though it should be stated that the open weather has contributed to a steady forwarding of ore from dock to furnace. There are, of course, no definite figures as to the amount of ore in the stock piles at the various furnaces, but of course it must be abundant.

The shipments to furnaces between May 1 and Dec. 1 of the present year aggregate 24,311,720 tons, compared with 16,658,806 tons in 1904; with 16,903,013 tons in 1903, with 18,423,364 tons in 1902 and 14,204,596 tons in 1901. The shipments to furnaces during the navigation season as referred to are determined in this way: First we have the amount of ore on Lake Erie docks before the opening of navigation, May 1 last, 2,271,631 tons; add to this the receipts of the season just closed, 28,479,056 tons, and the total is 30,750,687 tons; deduct the amount on dock Dec. 1, 6,438,967 tons and we have 24,311,720 tons as the amount that was forwarded either direct, or from dock to furnace yards.

It is understood, of course, that the difference between the output of 33,476,904 tons which was shipped from the mines during 1905 and the receipts of 28,479,056 tons at Lake Erie ports, is ore that went to places other than Lake Erie ports, such as furnaces at Detroit and South Chicago.

The following table shows receipts at Lake Erie ports and amounts on dock during five years past:

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS

Ports	1905	1904	1903	1902	1901
Toledo	1,006,855	508,793	652,305	1,037,571	798,298
Sandusky	51,202	48,356	130,532	165,556	33,017
Huron	825,276	231,364	486,106	520,646	431,311
Lorain	1,605,823	972,931	990,490	1,442,417	721,662
Cleveland	5,854,745	3,572,228	4,434,160	4,873,318	3,831,060
Fairport	2,008,621	1,157,858	1,434,842	1,538,744	1,181,776
Ashtabula	6,378,779	3,639,250	4,242,160	4,796,805	3,981,170
Conneaut	5,327,552	4,083,655	3,903,937	4,300,301	3,181,019
Erie	2,112,476	1,284,778	1,257,798	1,717,268	1,379,377
Buffalo / Tonawanda	3,312,725	2,433,601	2,149,901	2,256,798	1,475,896
Total	28,479,056	17,932,814	19,681,781	22,649,424	17,014,076

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS

Ports	1905	1904	1903	1902	1901
Toledo	368,024	318,573	106,710	310,023	254,196
Sandusky	52,977	75,134	95,275	95,175	47,384
Huron	208,023	182,495	253,249	232,764	231,501
Lorain	271,695	299,504	288,581	328,304	195,863
Cleveland	1,330,619	1,237,033	1,337,750	1,500,604	1,378,060
Fairport	759,961	680,420	845,946	924,236	710,590
Ashtabula	1,589,951	1,403,575	1,911,911	1,967,136	1,769,145
Conneaut	976,976	684,487	591,364	673,679	604,106
Erie	564,961	583,439	657,409	722,966	470,718
Buffalo	315,780	318,739	282,890	319,367	198,100
Total	6,438,967	5,763,399	6,371,085	7,074,254	5,859,663

PITTSBURG STEAMSHIP CO. AND ITS MASTERS.

The Pittsburg Steamship Co. during the present week held conferences at the Colonial Hotel at Cleveland with the masters of its vessels. The masters were met by President and General Manager Harry Coulby, Assistant General Manager A. F. Harvey, Traffic Manager E. C. Collins, Superintendent Capt. W. W. Smith, Chief Engineer F. B. Smith and Capt. Dennis Sullivan, the Chicago agent. Plans for next season were discussed and the utmost good feeling and harmony reigned between the masters and the officials. While the appointments of vessels have not as yet been given out, the vessels of the fleet have been divided into three classes and an announcement has been made as to who will go in the various classes.

The following is the list of captains that have been appointed for first class steamers: W. S. Hoag. M. A. Boyce, J. W. Morgan, W. H. Campau, F. A. Bailey, W. H. Kilby, Frank Rice, Arthur Montague, A. J. Talbot, C. H. Cummings, James Burr, E. O. Whitney, C. J. Grant, Neil Campbell, C. G. Ennis, Richard Jollie, James A. Walsh, A. R. Robinson, J. C. Bell, J. H. Smith, D. P. Wright, George Banker, John Nahrstedt, A. C. Chapman, John Parke, R. F. Humble, J. Laframboise, John Lowe, James Leisk, W. H. Moody, W. C. Iler, A. P. Chambers, G. Gegenheimer, S. C. Allen, John Burns, M. K. Chamberlain, W. B. McGregor, F. J. Crowley, Fred Hoffman, W. J. Hunt and H. Culp.

The following captains are selected for steamers of the second class and as there will be vacancies in the first class list several of them will be promoted during the season.

George Holdridge, J. T. Gemmel, H. J. Regan, J. A. Ferguson, E. Dyble, A. Hanson, H. Harbottle, A. C. Smith, N. H. Reed, A. R. Thompson, J. R. Noble, F. C. Watson, C. A. Weitzman, H. Gegeoux, George Randolph, G. H. Bowen, Oscar Olson, Robert Brooks.

Masters of the steamers of the third class who are in line for promotion are as follows:

T. J. Cullin, A. G. McLeod, E. L. Sawyer, N. E. Stover, Thomas Wilson, C. A. Boyce, J. H. Clapp, H. Walper, J. C. Bell, C. D. Secord.

LUMBER SHIPMENTS FROM DULUTH.

P. M. Shaw, Jr., & Co., lumber brokers of Duluth, have compiled some interesting statistics of the lumber industry at the head of the lakes and vicinity for 1905, together with comparisons for preceding years. The total amount of lumber shipped from the Duluth-Superior harbor for the year is given at 299,000,000 ft., as compared with 294,000,000 ft. in 1904. In addition to this there was received at Duluth-Superior 169,000,000 ft. of lumber for shipment in vessels from the interior mills, and also 7,000,000 ft. of fir consigned to Lake Erie, making a grand total of lumber shipments from the harbor of 475,000,000 ft. as compared with total shipments in 1904 of 417,000,000 ft.

The shipments through Duluth harbor from interior mills last year amounted to 123,000,000 ft. The amount of lumber shipped this year from Two Harbors was 56,000,000 ft. as compared with 57,000,000 feet in 1904.

Lumber manufactured on the Duluth-Superior harbor this year amounted to 292,000,000 ft., as compared with 285,000,000 ft. in 1904. Total amount of lumber on dock Dec. 1, this year, was 89,000,000 ft., of which 33,000,000 ft. was unsold. The amount unsold on the same date last year was 51,000,000 ft. and the total on dock was 96,000,000 ft. The average freight rate this year was $2.15 per thousand feet, as compared with $2.26 in 1904, and the last cargo left Dec. 7.

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MR. W. I. BABCOCK'S RECENT WORK.

Mr. W. I. Babcock, who is well known on the great lakes, has recently been appointed New York representative of the Bath Iron Works, Bath, Me. He has also made an arrangement with the Sub-Surface Torpedo Boat Co. of New York to do certain work for them, both in New York and Washington in connection with the "Waterclad" torpedo boat. This new type of boat consists practically of a submarine torpedo boat, containing all the machinery, torpedoes and vitals, suspended below the surface by a narrow waist from a low shoal surface hull, which is built of thin steel and divided into compartments filled with cellulose, so as to maintain its buoyancy and stability, and thus the efficiency of the whole boat even if the exposed hull should be riddled with shot. The lower hull, being totally submerged at all times, is perfectly protected from gun-fire. There is an armored deck separating the two hulls at the waist and from this armored deck rises above the upper deck a heavy armored conning tower, which is proof against rapid-fire guns. In action all the crew except the commander are in the lower hull and the commander himself is protected in the tower. The boat is driven by gasoline engines. The REVIEW hopes to be able at a later date to publish a complete description of this craft which appears to have warlike propensities, of an exceedingly important character. Mr. Babcock is also building at Rockland, Me., a wooden fourmasted schooner to carry 3,000 tons of coal and which is to have an auxiliary gasoline engine of about 500 H. P. He is doing a great deal of consulting work for the Erie railroad, including a big wooden car float now building at Bath, Me. Lately on the lakes he has done a great deal of work in going over the plans for new steamers, including those for the Pittsburg Steamship Co. and various alterations on a number of old boats.

GRAIN SITUATION AT DULUTH.

Duluth, Minn., Jan. 1.—Grain is coming to the head of the lakes slowly, and the receipts cannot fill the elevators before spring unless there is a change in the rate of arrival. The slow delivery is doubtless largely on account of the railroad car famine, which is as stringent as ever throughout the northwest. Country elevators are full of grain and many districts are unable to deliver to these houses, as the stuff cannot be received by them.

The Superior elevators of the Peavey system are all closed for the winter, on account of the fight of Superior for an independent system of grain inspection and weighing. Half of the 4,000,000 bushels of wheat at the head of the lakes is in the Peavey house at Duluth, and most of the rest is in Consolidated Co. houses, also in this city. The new Capitol elevator is taking in some wheat now. The inspection matter has been a serious detriment to Superior so far and will doubtless have its effect for years; it surely will stop any possible negotiations for the construction of grain warehouses there for many years to come.

Active work has begun in the construction of the No. 4 ore dock of the Duluth, Missabe & Northern road, and in the new coal piers and dock improvements of the Duluth & Iron Range. These two roads are spending this winter, in docks, new trackage, rolling stock, and the like, more than $5,500,000, most of it by the first named. Both will have through double tracks on their main lines next spring, and their combined ore car equipment will be in the neighborhood of 9,000 cars, of which about two-thirds will be steel 50-ton cars. The Duluth, Missabe & Northern will have far better equipment for handling logs and lumber another year and expects to move a vast amount of the latter from mills in the interior, along its line.

MURRAY SAND BLAST.

An exhibition of the Murray sand blast apparatus was given on the steamer Albright in No. 1 drydock at Cleveland in the presence of a number of vessel owners this week. The principle of the sand blast is not new, but this is the first apparatus invented that uses it at 100 lbs. pressure. The machine is portable and simple in construction and weighs about 200 lbs. The sand blast is operated with two separate hose, connected from the sand tank to a nozzle. One hose carries air which is expanded in a jet of high velocity through a 3-16-in. orifice. A second hose takes a mixture of sand and air at a lower velocity and feeds it into this jet. The combined jets of air and sand then pass out through the end of the nozzle, a ¼-in. orifice, at very high velocity. The sand and air meet at the tip of the nozzle, which is the only wearing part. The tips last about an hour, and cost one cent each. For cleaning iron and steel this sand blast is especially effective, as was very readily demonstrated on the Albright. It removes rust, old paint and barnacles from the sides and bottoms of iron and steel ships rapidly. It is estimated that one man with the sand blast can do more than 100 men in cleaning iron rust. It is also especially effective in cleaning steel castings and in removing scale from boilers. The Murray sand blast is manufactured by the International Sand Blast Co., 503 California St., San Francisco, Cal., of which Mr. Alfred Carter is general manager. Mr. Carter is at present in Cleveland and says that a local company will be organized to manufacture the apparatus for the great lakes.

OHIO MACHINE & BOILER CO.

The Ohio Machine & Boiler Co., 181 River street, Cleveland, are installing twelve new furnaces of the Adamson type in the steamer City of Buffalo of the Cleveland & Buffalo Transit Co. The company has the work well under way and anticipates its completion early in March. The Ohio Machine & Boiler Co. purchased the plant of the Union Machine & Boiler Co. outright about three months ago. It is well prepared for marine work of all kinds, having an excellent equipment and an advantageous location. Two of the active members of the company are old and experienced boiler men, thoroughly conversant with every phase of marine boiler making and repairing, having, until the formation of this new company, held positions of responsibility in the boiler department of the American Ship Building Co.

Among the recent shipments of Roberts boilers, manufactured by the Roberts Safety Water Tube Boiler Co., of New York, are the following: One to Messrs. Hughes Bros. & Bangs, N. Y.; one to United States steamer Ingalls, one to the Atlantic Works, Boston, Mass.; five to Messrs. James Beggs & Co., N. Y., for export; one to the Buchholtz Reversible Turbine Syndicate, England; one to the Chilian schoolship; one to Mr. Henry J. Gielow, N. Y.; another to Mr. R. M. Spellman, N. Y.; one to the Truscott Boat Manufacturing Co., St. Joseph, Mich.; two to Messrs. Pusey & Jones, Wilmington, Del.; one for the United States steamer General Howe; another for the Isle of Pines steamship to run between that island and Havana, Cuba; one to Mr. W. I. Babcock, for the steam schooner Francis Hyde, built at Bath, Me., and owned by the Benvenue Granite Co., of New York, and two to the Wilmington, Southport & Little River Co., of Wilmington, N. C.

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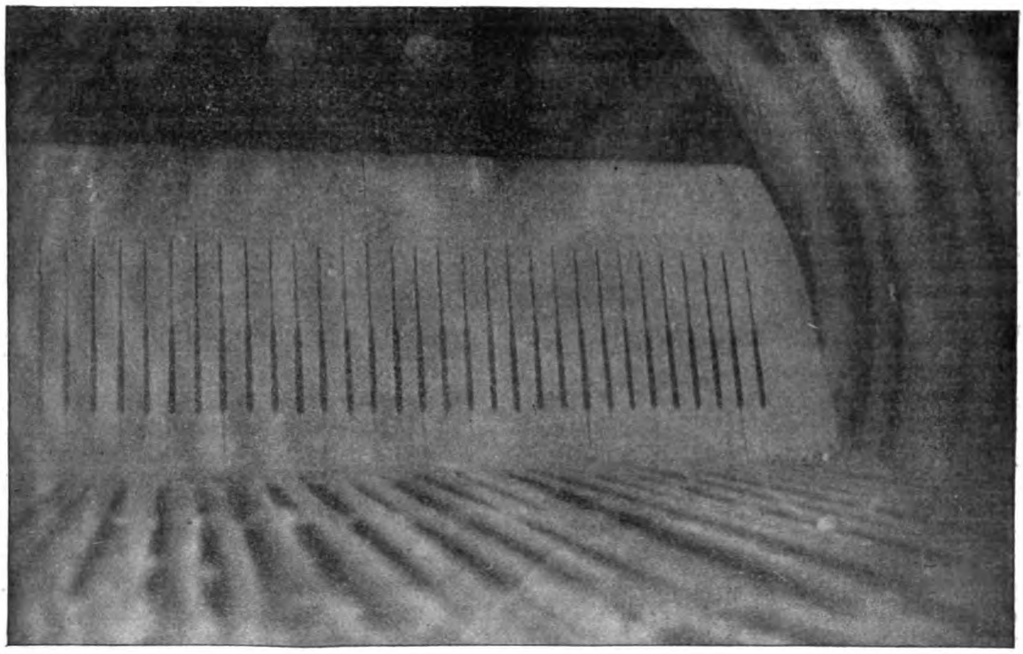
STURROCK PATENT FURNACE BRIDGE WALL.

There is herewith published an interesting illustration of the inside of the furnace of a Scotch boiler, showing a Sturrock patent bridge wall, which has been in practically continuous use for over four years. The difference of the effect of the fire on the grate bars and on the bridge wall is well shown, the bridge wall being practically as perfect as when first put in, while the grate bars have become somewhat burned on the top.

The use of these bridge walls has been largely extended during the past year, both in British and United States ships, and the manufacture of them in Dundee, Scotland, where they were originated, has become one of the established industries of that city. Their use is not confined to marine lines, but has been extended to stationary boilers as well, and they have proved to be easily adaptable to nearly all types of marine and stationary boilers and with widely varying conditions of natural and artificial draft.



STURROCK PATENT FURNACE BRIDGE WALL.

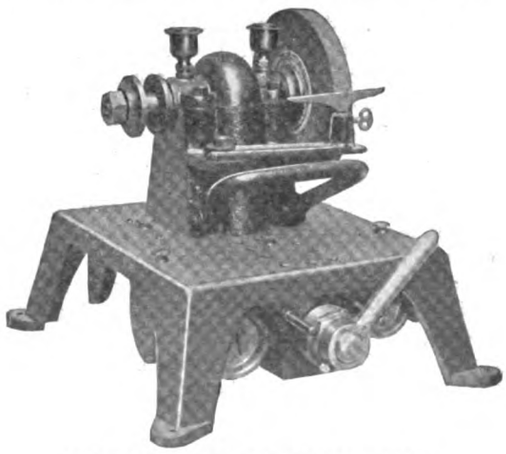
These bridge walls have been introduced in many of the steamers of the great lakes through Mr. Alexander Hynd, No. 209 Western Reserve Building, Cleveland, O., who has lately issued a very complete and attractive circular giving full information as to their use and from whom all particulars may be obtained on application.

WILL NOT DO STEAMBOAT WORK.

The American Bridge Co., which has been very successful in the construction of coal boats and barges at its plant on the Ohio river at Ambridge, Pa., has decided that it will not branch out into regular steamboat work. The company now has the contract for construction of a packet hull for James Rees & Sons Co., which latter concern has the contract for a new steamboat for the Memphis & Arkansas River Packet Co. When this is completed the river work of the bridge company will be confined to open barge and coal boat building and no model hulls will be undertaken. The company in order to successfully take model hull work, would of necessity have to greatly increase its equipment, which, in view of the heavy demand for the present capacity of the Ambridge plant on bridge and structural work, is not deemed advisable at this time. The bridge company, however, has ample equipment for the construction of coal boats and barges and expects to do considerable business in this line. The ten barges built for the American Steel & Wire Co. have been eminently satisfactory, and the dredge hull and sand barge turned out by the plant have met every expectation.

HELWIG PORTABLE PNEUMATIC GRINDER.

The Helwig portable pneumatic grinder, manufactured by the Helwig Mfg. Co., St. Paul, Minn., shown below, is specially adapted for use in shipyards, structural steel works and places where a stationary grinder, on account of distance from work in hand, is not readily available. It has a handle by which it can be carried to the place most convenient to work. It is operated by compressed air, which is at all times available in above mentioned places where it can be instantly connected to any suitable air hose. This grinder is driven by a type of the well known Helwig pneumatic motors and is entirely encased which protects it from dirt and dust. The machine weighs but 50 pounds, and is very durable and compact, occupying a floor space of 12 x 15 and is only 12 inches high. It is equipped with an emery wheel ¾ x 6 inches and suitable rest. The throttle for stopping and starting is conveniently located in front of the machine. This grinder also has a clamping device by which it may be instantly clamped to an I-beam, angle iron, or other convenient place near the workmen and in any position.



HELWIG PORTABLE PNEUMATIC GRINDER.

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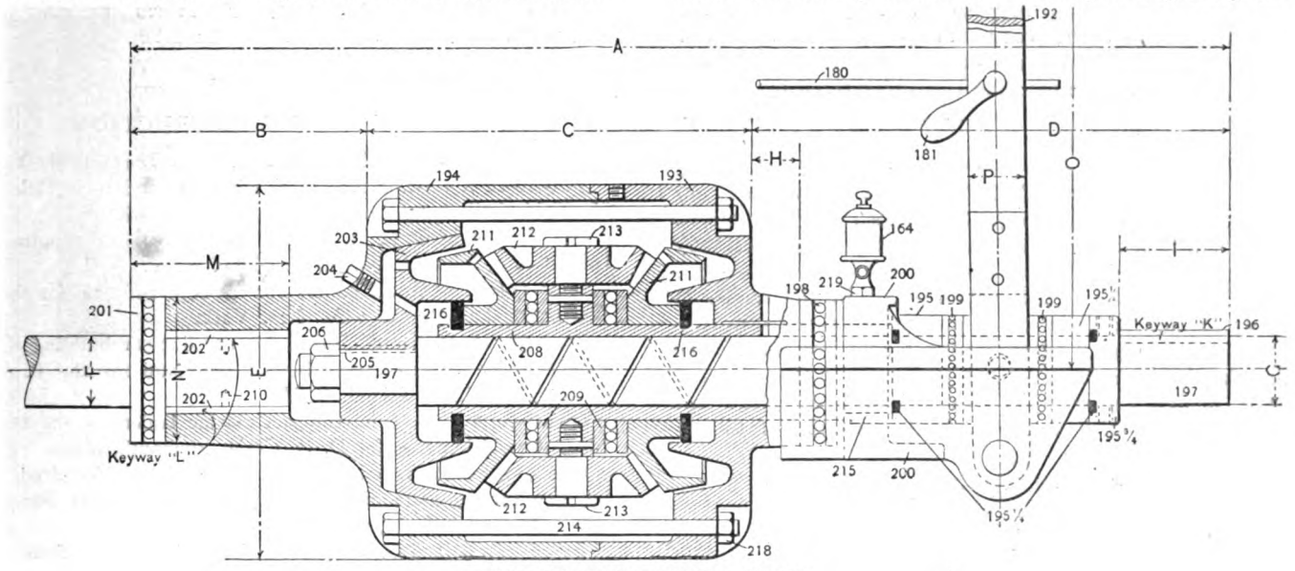
MIETZ REVERSING FRICTION CLUTCH.

August Mietz, manufacturer of the Mietz & Weiss oil and gas engine, has a very interesting reversing friction clutch, the mechanism of which is explained in the accompanying line drawing. The engine shaft F is keyed to casing 194 by two keys 202. The casing 194 is rigidly bolted to casing 193. The stub shaft G carries at its inner end the friction disk 203 which engages inner friction surface of casing 194. This shaft has a longitudinal movement by the lever and phosphor-bronze yoke ring held between two roller bearing thrust collars 199 and collars



MIETZ REVERSING FRICTION CLUTCH.

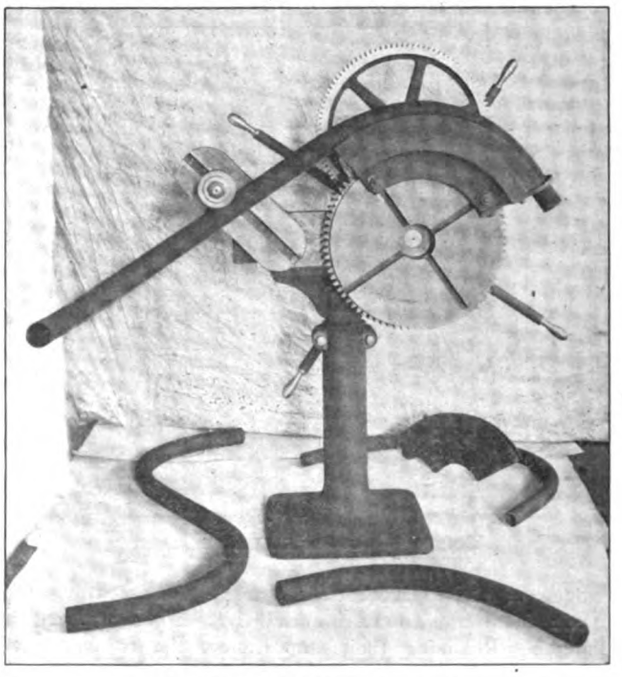
195-195¼ and 195½ and 195¾, collars 195¼ being locked in a circular groove on the shaft. The bronze sleeve 208 has a longitudinal movement only in the casing and outer bearing 200, a feather 215, in the bearing 200, preventing rotation. This sleeve carries two pinions and two gears, the latter being held between collars 216 and ball thrust collars 209, but left free to rotate. The two gears 211 have friction surfaces to engage with the friction disc 203 and inner surface of casing 193 respectively. The propeller shaft is coupled to the projecting part I of the stub shaft G.

Operation.—Suppose the engine shaft and with it the casing to rotate, and lever 192 pushed to the left which brings friction disc 203 into engagement with friction surface of casing 194, rotating the shaft G and with it the propeller shaft in the same direction. The thrust of the propeller is therefore directly on the friction cone and main thrust roller bearing 201 against the frame of the engine. The crank shaft of the engine is, however, relieved of all longitudinal strain. In this position the gears are not in motion. Pushing the lever 192 to the right, friction disc 203 is disengaged from the casing 194 and the shaft G and the propeller shaft stops. A further movement of the lever 192 to the right brings friction disc 203 into contact at its inner friction surface with gear 211, and further movement causes the sleeve 208 to slide to the right until gear 211 engages the inner friction surface of casing 193. the pinions 212 causing the disc 203 and with it the shaft G and propeller shaft to rotate in the opposite direction. The back thrust of the propeller shaft is now taken up by the thrust roller bearing resting against the fixed bearing 200.

These reversing clutches are furnished with the Mietz & Weiss marine oil engines from 6 H. P. up; if ordered separately they are furnished complete as shown in cut except the lock bar 180 and handle 181.

MACHINE FOR BENDING PIPE COLD.

The accompanying photograph illustrates a machine that has lately been perfected for bending pipe cold. Piping of steel, iron, brass, copper or other material can be bent cold up to and including 2-in. diameter. The machine is adaptable by means of special formers for bending light angles, flats and tee bars. The gearing is compound with a ratio of 25 to 1, thus giving the machine a powerful leverage. A boy can bend 2-in. pipe with little effort. The machine is operated by a handwheel, consisting of four handles, which by means of the compound gearing engages the face plate to which are attached the bending quadrants. The pipe is held in the quadrant at one end by a steel plate, while the resistance stud on the movable arm engages the other end. The various curvatures are



MACHINE FOR BENDING PIPE COLD.

obtained by adjusting the arm, which has a swing of three-quarters of a circle, supplemented by the movement of the resistance stud in the "T" slot of arm.

The machine is mounted on a telescopic stand, which

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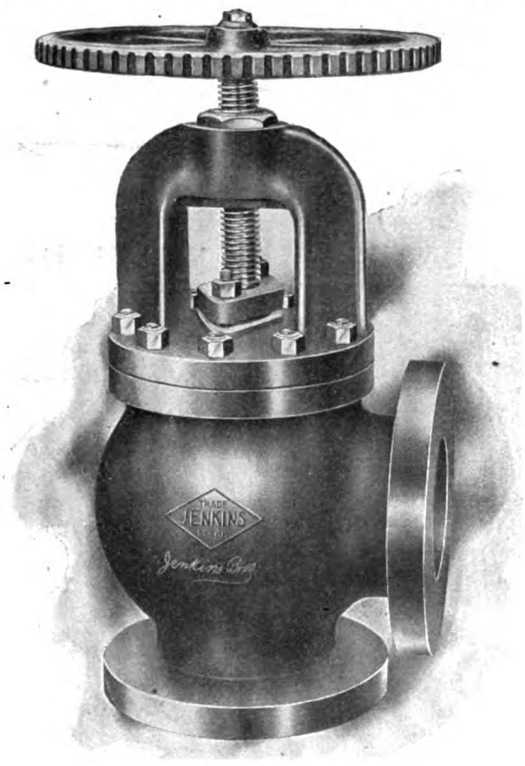
can be raised or lowered to any suitable height; when the base is fastened, the upper part swivels. A universal arm or section for the stand is furnished, so that if so desired, the face plate may be placed in a horizontal position at any height from the floor.

Quadrants are furnished with the machine for 1-in. pipe with a radius of 6 inches, for 1¼-in. pipe with a radius of 9 inches, for 1½-in. pipe with a radius of 12 inches, and for 2-in. pipe with a radius of 14 inches. While these four quadrants are furnished with the machine, it is found that the smaller sizes of pipe can be readily bent in the larger size quadrants very satisfactorily. In fact, few workmen will take the time to change the quadrants unless they require a shorter radius than the larger quadrant will give them. The machine is manufactured by Pedrick & Smith, Church Lane, and P. & R. Railway, Germantown, Philadelphia, Pa.

JENKINS BROS.' IRON BODY VALVES.

About four years ago Jenkins Bros., 71 John street, New York, placed on the market a line of extra heavy brass valves suitable for working pressures up to 300 lb. These valves found instant favor in the hands of users of high pressure steam and the company was constantly in receipt of letters asking for an iron body valve for the same work. To meet this demand the company now manufacturing extra heavy iron body globe and angle valves, which in its judgment are superior to any



JENKINS' BROS. IRON BODY VALVES.

valves of their class in the market. These valves are made from 2½ to 12 in. inclusive, either screwed or flanged. Realizing their importance, the company has spared no effort to make them representative high pressure valves and guarantees them for a working pressure of 250 lbs. The materials used in their construction are of the best quality and the workmanship is unsurpassed. In their design, strength and rigidity have been very carefully considered and they will easily withstand the stresses and strains due to the expansion and contraction of the piping, etc. Before leaving the factory, each valve is tested with 800 lb. hydraulic pressure. The company can supply the valves from 5 to 12 in. inclusive, with by-pass, which is cast integral with the body. The by-pass of the 12-in. valves is fitted with an iron yoke bolt; below 12 in. the by-passes are fitted with brass bolts which are screwed into the body of the by-pass. All the extra heavy iron body flange valves are fitted with the manufacturers' standard extra heavy flanges and the drilling when ordered will be in accordance with the standard, unless otherwise specified. The company advises the use of flanged valves 7 in. and above.

MACHINERY UNDER CONSTRUCTION.

Kingsford Foundry and Machine Works, Oswego, N. Y.:

Two 10 ft. x 12 ft. Scotch marine boilers for lighter Helen M. Fields built for John Arbuckle of New York City.

One 6 ft. 3 in. x 14 ft. vertical marine boiler for lighter building for John M. Worth, Brooklyn, N. Y.

Four 125 H. P. Ideal boilers for dredges building for the International Contracting Co., New York.

Two 250 H. P. Scotch boilers for car dumper building by the McMyler Manufacturing Co. of Cleveland for the B. & O. Railroad, Staten Island, N. Y.

One 8 ft. x 11 ft. 6 in. compact marine boiler for the tug Mary Arnold building for D. H. Craig, Plymouth, Mass.

One 9 ft. x 12 ft. 6 in. Scotch marine boiler for dredge building for the state of Florida by the Featherstone Foundry & Machine Works, Chicago.

One 6 ft. x 9 ft. 6 in. compact marine boiler for tug Samuel Hartman building for J. W. Paxson Co., Philadelphia, Pa.

Two 250 H. P. Scotch boilers for car dumper building by the McMyler Mfg. Co., of Cleveland.

One 4 ft. 6 in. x 8 ft. compact marine boiler for tug Sprudel building for Reger & Werner Fish Co., Lorain, O.

Two 9 ft. x 10 ft. Scotch marine boilers for dredges building for Panama by the Atlantic Equipment Co. of New York City.

Two 150 H. P. Ideal boilers for dredge building for the Atlantic, Gulf & Pacific Co. of New York.

One 7 ft. 6 in. x 12 ft. 6 in. compact marine boiler for tug Katherine Francesca building for M. J. Dady, Brooklyn, N. Y.

One 5 ft. x 9 ft. compact marine boiler for the tug Cassie, building for the T. A. Scott Co., New London, Conn.

One 11 ft. x 12 ft. Scotch marine boiler for the tug Bessie H. Dantzler, building for the L. N. Dantzler Lumber Co. of Moss Point, Miss.

One 9 ft. x 11 ft. Scotch marine boiler for a tug, the hull of which is being built at Mobile, Ala.

Bertelsen & Petersen, 140-146 and 256 Border St., East Boston, Mass.:

One fore and aft compound engine, having cylinders 13 and 28 in. diameter by 20-in stroke; one fire box flue and return tubular boiler 8 ft. diameter, 11 ft. long, 140 lbs. steam pressure for new tug for Capt. N. P. Doane of Boston, hull for which is being built by Richard Keough of Boston.

One single engine with cylinder 18 in. diameter by 24-in. stroke and one boiler of the fire box flue and return tubular type, 7 ft. 6 in. diameter and 13 ft. 6 in. long, with 115 lb. steam, for new tug for the Commercial Tow Boat Co., of Boston. Hull is being built by Richard Keough of Boston.

Phoenix Foundry & Locomotive Works, St. John, N. B.:

Compound engine with cylinders 14 and 28 in. diameters by 4-ft. stroke, steam at 135 lbs. pressure being supplied by a locomotive boiler 5 ft. diameter by 17 ft. long, for steamer Hampton which is to run from St. John to Hampton.

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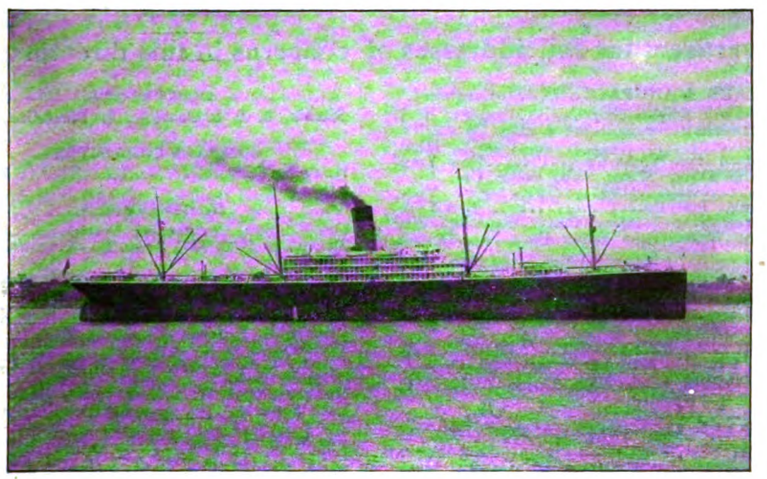
Hyde Windlasses and Capstans



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Boston New York Chicago

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Buyers' Directory of the Marine Trade

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by The Marine Review, Cleveland.

See accompanying index of Advertisers for full addresses of concerns in this directory.

AIR COMPRESSORS, AIR HOISTS, ETC.
Great Lakes Engineering Works.....Detroit.
Mietz, Aug. .....New York.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.....New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works.....Detroit.

ANCHORS.
Bowers, L. M. & Co.....Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons.....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit
Great Lakes Engineering Works.....Detroit
Sturtevant, B. F., Co.....Hyde Park, Mass.

ASH EJECTORS.
Great Lakes Engineering Works.....Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley.....Cleveland.
Jenkins, Russell & Eichelberger....Cleveland.
Kremer, C. E.....Chicago.
MacDonald, Ray G.....Chicago.
Shaw, Warren, Cady & Oakes.....Detroit.
White, Johnson, McCaslin & Cannon Cleveland

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.....Brookline, Mass.

BLOCKS, SHEAVES, ETC.
Boston & Lockport Block Co.....Boston, Mass.
Cleveland Block Co.....Cleveland.

BLOWERS.
Power Specialty Co.....Detroit.
Sturtevant, B. F. Co.....Hyde Park, Mass.

BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, David.....New York.
Lane & DeGroot....Long Island City, N. Y.
Marine Construction & D. D. Co.....
.....Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co.....St. Joseph, Mich.
Willard, Chas. P. & Co. Winthrop Harbor, Ill.

BOILER CLEANING DEVICE.
Power Specialty Co.....Detroit.

BOILER COMPOUNDS.
The Bird-Archer Co..... New York
Dearborn Drug & Chemical Works....Chicago.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co..Providence, R. I.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
Cramp, Wm. & Sons.....Philadelphia.
Dearing Water Tube Boiler Co.....Detroit.
Detroit Ship Building Co.....Detroit.
East End Boiler Works.....Detroit.
Fletcher, W. A. & Co.....Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Kingsford Foundry & Machine Works....
.....Oswego, N. Y.
Marine Iron Works.....Chicago.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher Water Tube Boiler Co....New York.
Newport News Ship Building Co.....
.....Newport News, Va.

BOILER MANUFACTURERS—Continued.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co....
.....Duluth, Minn.
Quintard Iron Works Co.....New York.
Roberts Safety Water Tube Boiler Co....
.....New York.
Stirling, The Co..... New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co.....Detroit.

BOILER RIVETS.
Bourne-Fuller Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co..Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons.....Philadelphia.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Lunkenheimer Co.....Cincinnati.
Macbeth Iron Co.....Cleveland.

BRIDGES, BUILDERS OF.
Cowing, John P.....Cleveland.
Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co.
..... Cleveland.

BULKHEAD DOORS, WATERTIGHT.
"Long Arm" System Co.....Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.....Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.....Buffalo.
Bunker, E. A. .....New York.
Upson-Walton Co.....Cleveland.

CAPSTANS.
American Ship Windlass Co..Providence, R. I.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.....Jersey City, N. J.

CHAINS.
Woodhouse Chain Works.....Trenton, N. J.

CHAIN CONVEYORS, HOISTS.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.
General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co....Boston, Mass.

CHARTS.
Penton Publishing Co.....Cleveland.
Potter, J. D.....London.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ashton Valve Co.....Boston.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co.....Cleveland.
Ironville Dock & Coal Co.....Toledo, O.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.

COAL AND ORE HANDLING MACHINERY.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.

COMPASSES.
Ritchie, E. S. & Sons.....Brookline, Mass.

COMPASS CORRECTORS.
How, Benj. V..... Boston

CONDENSERS.
Great Lakes Engineering Works.....Detroit.
Thropp & Sons Co., John E...Trenton, N. J.

CONTRACTORS FOR PUBLIC WORKS.
Breymann & Bros., G. H.....Toledo.
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Dunbar & Sullivan Dredging Co.....Buffalo.
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Great Lakes Dredge & Dock Co.....Chicago.
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Hubbell Co., H. W.....Saginaw, Mich.
Lake Superior Contracting & Dredging Co.,
..... Duluth, Minn.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.....Detroit.

CORDAGE.
Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

CORK JACKETS AND RINGS.
Armstrong Cork Co.....Pittsburg, Pa.
Kahnweiler's Sons, D.....New York.

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Brown Hoisting Machinery Co.....Cleveland.

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Schrader's Son, Inc., A..... ... New York.

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Sturtevant Co., B. F.....Hyde Park, Mass

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Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co.....Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
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Hubbell Co., H. W.....Saginaw, Mich.
Lake Superior Contracting & Dredging Co.
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Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.....Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.....New York.

DRYING APPARATUS.
Sturtevant, B. F. Co.....Hyde Park, Mass.

DRY DOCKS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.
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Shipowners Dry Dock Co.....Chicago.
Superior Ship Building Co....Superior, Wis.
Tietjen & Lang Dry Dock Co.....Hoboken, N. J

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....Manitowoc, Wis.

DYNAMOS.
General Electric Co.....Schenectady, N. Y
Mietz, Aug.....New York.
Sturtevant, B. F. & Co.....Hyde Park, Mass.
Thropp & Sons, John E.....Trenton, N. J.

ECONOMIZERS, FUEL.
Sturtevant Co., B. F.....Hyde Park, Mass.

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General Electric Co.....Schenectady, N. Y.

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WANTED and FOR SALE Department.

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U. S. Engineer Office, Buffalo, N. Y. November 27, 1905.—Sealed proposals for excavation in Black Rock Harbor, Buffalo, N. Y. will be received here until 11 A. M. January 15, 1906, and then opened. Information furnished on application. H. M. Adams, Col. Eng'rs.

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Marine Engine

FOR SALE,—One fore and aft compound marine engine, 27 cylinders, and 50 x 40. Built by the D. D D. Co. Enquire of THE MONTAGUE IRON WORKS, Montague, Mich.

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One combination Clamshell and Dipper Dredge. Machinery for clamshell dredge. A dipper dredge partly burned. Deck scow 112 x 32 x 9. Tug—14 x 16. Several dredge dippers. Three 100-yd. dump scows. Miscellaneous appliances Office with safe and fixtures, all to be closed out cheap.

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DETROIT, MICH.

Wanted to Purchase

For a small tug, 14 x 14 or 14 x 16, steam, not less than 100 lbs., or machinery of that size, to put in new hull. Address C. B Moiles, Saginaw, Mich.

WANTED.

Marine Engineer

WANTED.—At once, Marine Engineer for yacht navigating southern rivers f r pleasure. Yacht is equipped with fore and aft compound condensing engine. State salary expected and apply with references to MORRIS SHERMAN MFG. CO., Chattanooga, Tenn.

Scotch Boiler

WANTED.—A Scotch Marine Boiler allowed not less than 150′ steam. Pass U. S. inspection. Shell about 9′ diameter and 10′ long. Must be in first-class con dition or new. Address 109 East 3rd St , Oswego, N. Y.

WANTED—One captain and one engineer on a freight and passenger line, and to take a financial interest in the company. Address Box 91, care of MARINE REVIEW.

Second Hand Boiler.

Wanted—Second hand Marine Boiler for walking beam condensing engine 36" x 10′ stroke Boiler to have a grate surface of 50 square feet and carry a working pressure of 50 lbs Canadian inspection.

Richelieu & Ontario Navigation Co.
Montreal, Can.

WANTED.

BOILER WANTED.

Good second-hand boiler, one that has not been used very long and is in good condition, about 9 or 10 ft. long and 4½ or 5 ft. in diameter. Address DORMER BOUTEN-FISH CO., Bayfield, Wisconsin.

WANTED,

Three Lake Schooners

Rated not less than A2 capacity, 1400 to 1600 gross tons on thirteen feet draft. Give number and size of hatches with distance between centers. Address

Pentecost Lumber Co.,
Cape Vincent, N. Y.

For Sale

Steamer Oregon lying in Milwaukee; Length of keel, 197 ft.; beam, 33 ft.; depth of hold, 13 ft. 9 in. Built in 1892, rebuilt 1903. Registered tonnage, 779 gross, 557 net. Boiler built in 1887, M. Riter, Buffalo, 16 ft. long, 120 inches diameter, allowed 100 pounds steam. Engine steeple compound, 20 x 40, 32 inch stroke. Capacity, lumber average 735 M ft.; wheat, 41,000; hard coal, 1200; soft coal, 1150; ore, 1100. J. A. CALBICK & CO., 44,-2 Sherman St., Chicago, Ill.

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Sturtevant, B. F. & Co.....Hyde Park, Mass.
Thropp & Sons, John E.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. .....Philadelphia.
Lockwood Mfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrows Point, Md.
Mietz, Aug. .....New York.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher, Chas. D.....New York.
Moulton Steering Engine Co.....New York.
Newport News Ship Building Co.....
.....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Mich.
Quintard Iron Works Co.....New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co.....Trenton, N. J.
Trout, H. G.....Buffalo.

ENGINE BUILDERS, STEAM.
Sturtevant Co., B. F.....Hyde Park, Mass.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co.....New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Kieley & Mueller .....New York.
Lunkenheimer Co. .....Cincinnati.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander .....Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Roelker, H. B. .....New York.
Wood, W. J. .....Chicago.

FANS FOR VENTILATION, EXHAUST, ETC.
Sturtevant, B. F. Co.....Hyde Park, Mass.

FEED WATER PURIFIERS AND HEATERS.
Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.
Ross Valve Co.....Troy, N. Y.

FIRE EXTINGUISHERS.
Safety Fire Extinguisher Co.....New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.....Schenectady, N. Y.

FORGES.
Sturtevant, B. F. Co.....Boston.
Sutton Co., C. E.....Toledo, O.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co...Cleveland.
Fore River Shipbuilding Co.....Quincy, Mass.
Macbeth Iron Co.....Cleveland.

FLUE WELDING.
Fix's, S. Sons.....Cleveland.

FUEL ECONOMIZERS.
Sturtevant Co., B. F.....Hyde Park, Mass.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
Ironville Dock & Coal Co.....Toledo, O.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co.....Detroit.
Smith Coal & Dock Co., Stanley B. Toledo, O.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

GAS BUOYS.
Safety Car Heating & Lighting Co..New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.

GAUGES, STEAM AND VACUUM.
Ashton Valve Co.....Boston.
Lunkenheimer Co. .....Cincinnati.

GAUGES, WATER.
Bonner Co., Wm. T.....Boston.
Lunkenheimer Co. .....Cincinnati, O.

GENERATING SETS.
Sturtevant Co., B. F.....Hyde Park, Mass.
General Electric Co.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J

GREASE EXTRACTORS.
Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Hyde Park, Mass.
Sutton Co., C. E.....Toledo, O.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co. (Inc.).....
..... Cleveland.
Chase Machine Co.....Cleveland.
General Electric Co.....New York.
Georgian Bay Engineering Works.....
.....Midland, Ont.
Hyde Windlass Co.....Bath, Me.
McMyler Mfg. Co.....Cleveland.
Marine Iron Co.....Bay City.
Mietz, Aug. .....New York.

HOLLOW SHAFTINGS, IRON OR STEEL.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works.....Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.....New York.

ICE MACHINERY.
Great Lakes Engineering Works.....Detroit.
Roelker, H. B.....New York.

INDICATORS FOR STEAM ENGINES.
Ashton Valve Co.....Boston.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros. .....New York.
Lunkenheimer Co.....Cincinnati.
Penberthy Injector Co.....Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co.....Chicago.
Fleming & Co., E. J.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A.....Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F..New York & Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON CASTINGS.
Sutton Co., C. E.....Toledo, O.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Marine Iron Works.....Chicago.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong, Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson .....Buffalo.

LOGS.
Nicholson Ship Log Co.....Cleveland.
Walker & Sons, Thomas....Birmingham, Eng.
Also Ship Chandlers.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. .....Cincinnati

LUMBER.
Martin-Barriss Co.....Cleveland.
Rayner, J. .....Chicago.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros.....Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MARINE RAILWAYS.
Hickler Bros.....Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.
Sturtevant, B. F. Co.....Hyde Park, Mass.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.

MOTORS, GENERATORS—ELECTRIC
General Electric Co.....Schenectady, N. Y.
Sturtevant, B. F. Co.....Hyde Park, Mass.

NAUTICAL INSTRUMENTS.
Benjamin Farnum How.....Boston
Ritchie, E. S., & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander .....Cleveland.
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Wood, W. J. .....Chicago.

OAKUM.
Stratford, Oakum Co.....Jersey City, N. J.

OIL ENGINES.
Mietz, Aug. .....New York.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph..Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Jenkins Bros. .....New York.
Katzenstein, L. & Co.....New York.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co. .....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.

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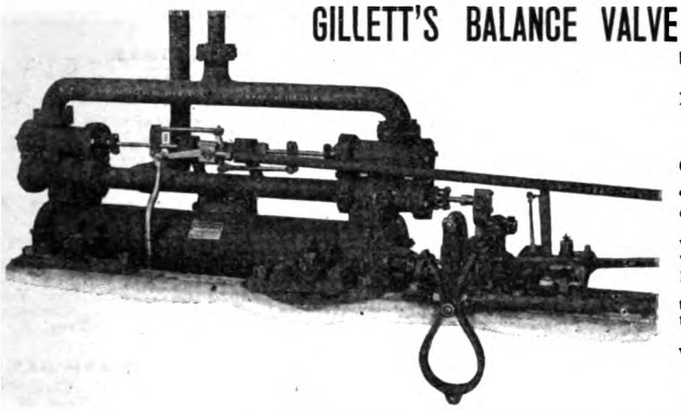


GILLETT'S BALANCE VALVE VARIABLE CUT-OFF STEAMBOAT ENGINES

Patented February 25, 1902. (Beware of infringements.)

ADVANTAGES:

LOW FIRST COST, ECONOMY IN STEAM CONSUMPTION,
SIMPLICITY, MINIMUM AMOUNT OF REPAIRS,
LIGHT WEIGHT AND NOISELESS IN OPERATION.

PLAQUEMINE, LA., Jan. 7th, '05.

Gillett & Eaton, Lake City, Minn.

Gentlemen:—The 10" x 60" engines that you built for the steamer "CARRIE B. SCHWING" are the finest and smoothest running that I ever saw and I believe they use less steam than any other engine built.

The wheel is 14 ft. in diameter, buckets 17 ft. long and 24" wide, and when the engines are cutting off at five-eighths stroke they turn the wheel 29 rev. per minute, at half stroke 26, and at three-eighths 23 rev. per minute.

Three-eighths is the point we cut them off at while towing timber and then she only burns 2½ cords per day, which costs the company $1.25 on the bank.

When I was building the boat I figured she would burn 5 cords of wood per day. Respectfully yours,

WM. ARNDT, Builder.

For further information write to

GILLETT & EATON, Lake City, Minn.

The Sturrock Patent Furnace Bridge Wall

ALEXANDER HYND, Agent for Great Lakes.

208-209 Western Reserve Building, Cleveland, Ohio.

SPECIAL ADVANTAGES

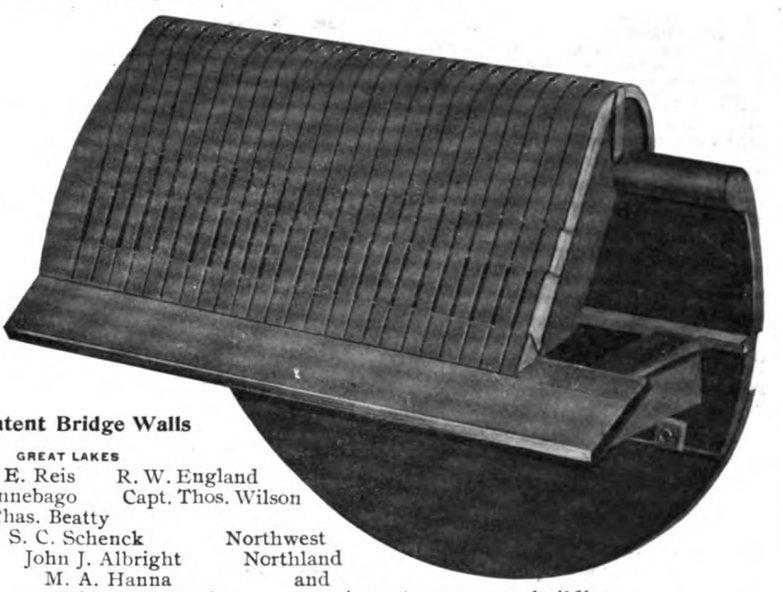
Can be removed without destroying any part of the bridge, and all replaced without requiring any renewals.

No dead fire at the bridge wall as no clinker ever collects on it.

Will not burn, warp or twist.

A permanent bridge wall entailing no expense for renewals.

Will save its cost many times over.



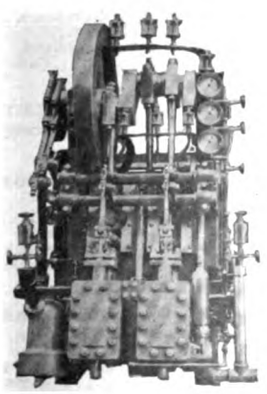
Some of the Steamers using Sturrock Patent Bridge Walls

BRITISH	AMERICAN COAST	GREAT LAKES	
Etruria	Catalone	Wm. E. Reis	R. W. England
Elsiston	Mystic	Winnebago	Capt. Thos. Wilson
Clematis	Silvia	Chas. Beatty	
Ellaston	Dominion	S. C. Schenck	Northwest
Unity	Rosalind	John J. Albright	Northland
Cleethorpes		M. A. Hanna	and
Leitrim		John C. Howard	six steamers now building

This bridge wall has now been in use in practically continuous service for four years with absolutely no cost for renewal or repairs

Owners or engineers desiring to have these fitted for the coming season of navigation will confer a favor by ordering early to avoid the rush during the period of fitting out in the spring.

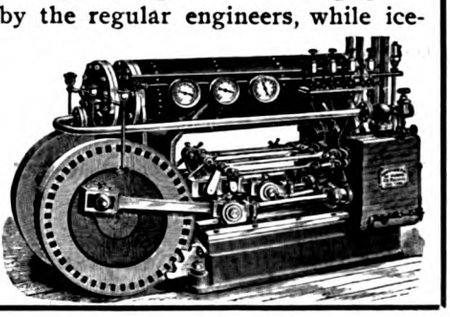
REFERENCES FROM ALL THE ABOVE USERS CAN BE FURNISHED ON APPLICATION



The ALLEN Dense Air Ice Machine

Contains no chemicals; only air at 65 lbs. pressure in pipes.

It is placed in the engine room and attended by the regular engineers, while ice-making box, meatroom and galley and pantry refrigerators are at the usual distant places. Proven by many years' service in the tropics on U. S. men of war, steam yachts and passenger steamers.



MORE THAN 150 IN DAILY SERVICE ON STEAM VESSELS.

It is as noiseless as any steam engine.

H. B. ROELKER

41 MAIDEN LANE, NEW YORK.

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Buyers' Directory of the Marine Trade.—*Continued.*

PILE DRIVING AND SUBMARINE WORK.

Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co.....Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W.....Saginaw, Mich.
Lake Superior Contracting & Dredging Co. ..... Duluth, Minn.
Parker Bros. Co., Ltd.....Detroit.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M..... Detroit

PIPE, WROUGHT IRON.

Bourne-Fuller Co.....Cleveland, O.
Macbeth Iron Co.....Cleveland.
Reading Iron Co.....Reading, Pa.

PLANING MILL MACHINERY.

Atlantic Works, Inc.....Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.

Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

PRESSURE REGULATORS.

Kieley & Mueller .....New York.
Ross Valve Co.....Troy, N. Y.

PROPELLER WHEELS.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co. .....East Boston, Mass.
Marine Iron Works.....Chicago.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co..... .....Newport News, Va.
Roelker, H. B.....New York.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp & Sons Co., J. E.....Trenton, N. J.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.

General Electric Co.....Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.

Great Lakes Engineering Works.....Detroit.
Marine Iron Works.....Chicago.
Kingsford Foundry & Machine Works..... .....Oswego, N. Y.

PUNCHES AND SHEARS.

Sutton Co., C. E.....Toledo, O.

RANGES.

Stamford Foundry Co.....Stamford, Conn.

REFRIGERATING APPARATUS.

Great Lakes Engineering Works.....Detroit.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes Register.....Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.

Bourne-Fuller Co.....Cleveland, O.

SAFETY VALVES.

Ashton Valve Co.....Boston.
Lunkenheimer Co. .....Cincinnati.

SAIL MAKERS.

Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

SALVAGE COMPANIES.

See Wrecking Companies.

SEARCH LIGHTS.

General Electric Co.....Schenectady, N. Y.

SHAFTING, HOLLOW.

Falls Hollow Staybolt Co..Cuyahoga Falls, O.

SHEARS.

See Punches, and Shears.

SHIP AND BOILER PLATES AND SHAPES.

Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

SHIP BUILDERS.

American Ship Building Co.....Cleveland.
Atlantic Works .....East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Ship Building Co.....Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Lockwood Mfg. Co.....East Boston, Mass.
Manitowoc Dry Dock Co.....Manitowoc, Wis.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co..... .....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Roach's Ship Yard.....Chester, Pa.
Shipowner's Dry Dock Co.....Chicago.

SHIP CHANDLERS.

Baker, Howard H. & Co.....Buffalo.
Marine Mfg. & Supply Co.....New York.
Upson-Walton Co.....Cleveland.

SHIP DESIGNERS.

Kidd, Joseph .....Duluth.
Steel, Nacey & Hynd.....Cleveland.
Wood, W. J.....Chicago.

SHIP LANTERNS AND LAMPS.

Russell & Watson.....Buffalo.

SHIPMATE RANGES.

Stamford Foundry Co.....Stamford, Conn.

SHIP TIMBER.

Martin-Barriss Co.....Cleveland.
Rayner, J. .....Chicago.

SMOOTH-ON COMPOUND, FOR REPAIRS.

Smooth-On Mfg. Co.....Jersey City, N. J.

STAYBOLT IRON OR STEEL BARS, HOLLOW OR SOLID.

Falls Hollow Staybolt Co..Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.

Gilchrist & Co., C. P.....Cleveland.
Holmes, Samuel .....New York.
Lester, S. S. .....Quebec, Can.
McCarthy, T. R.....Montreal, Can.

STEAMSHIP LINES, PASS. AND FREIGHT.

American Line .....New York.
Anchor Line .....Buffalo.
Boston Steamship Co.....Boston.
Cleveland & Buffalo Transit Co.....Cleveland.
International Mercantile Marine Co..... Philadelphia.
Mallory Line ....New York.
Merchants' Montreal Line.....Montreal.
New York & Cuba Mail S. S. Co...New York.
Red Star Line.....New York.
United Fruit Co.....Boston

STEEL CASTINGS.

Otis Steel Co.....Cleveland.
Sutton Co., C. E.....Toledo, O.

STEERING APPARATUS.

American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Ship Building Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.
Moulton Steering Engine Co.....New York.
Sheriffs Mfg. Co.....Milwaukee.

SUBMARINE DIVING APPARATUS.

Morse & Son, A. J.....Boston.
Schrader's Son, Inc., A..... ....New York.

SURVEYORS, MARINE.

Gaskin, Edward .....Buffalo.
Hynd, Alexander .....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Nacey, James .....Cleveland.
Steel, Adam .....Cleveland.
Wood, W. J.....Chicago.

TESTS OF MATERIALS.

Hunt, Robert W. & Co.....Chicago.
Lunkenheimer Co.....Cincinnati, O.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Watson-Stillman Co.....New York.

TOOLS, WOOD WORKING.

Atlantic Works, Inc.....Philadelphia

TOWING MACHINES.

American Ship Windlass Co..Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co..... .....Kingston, Ont.
Great Lakes Towing Co.....Cleveland.

TRAPS, STEAM.

Kieley & Mueller .....New York.
Sturtevant Co., B. F.....Hyde Park, Mass.

TRUCKS.

Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.

Shelby Steel Tube Co.....Pittsburg, Pa.

VALVES, STEAM SPECIALTIES, ETC.

Ashton Valve Co.....Boston.
Jenkins Bros. .....New York.
Kieley & Mueller.....New York.
Lunkenheimer Co.....Cincinnati.
Ross Valve Co.....Troy, N. Y.

VALVES FOR WATER AND GAS.

Lunkenheimer Co.....Cincinnati.
Ross Valve Co.....Troy, N. Y.

VARNISHES.

Detroit Varnish Co.....Detroit.
Detroit White Lead Works.....Detroit.
Also Ship Chandlers.

VENTILATING APPARATUS FOR SHIPS.

Sturtevant, B. F. Co.....Hyde Park, Mass.
Sutton Co., C. E.....Toledo, O.

VESSEL AND FREIGHT AGENTS.

Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Fleming & Co., E. J.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hall, John B.....Buffalo.
Helm & Co., D. T.....Duluth.
Hawgood & Co., W. A.....Cleveland.
Holmes, Samuel .....New York.
Hutchinson & Co.....Cleveland.
Lester, S. S. .....Quebec, Can.
McCarthy, T. R.....Montreal.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

WATER GAUGES.

Bonner Co., Wm. T.....Boston.
Lunkenheimer Co.....Cincinnati, O.

WATERTIGHT BULKHEAD DOORS.

"Long Arm" System Co.....Cleveland.

WHISTLES, STEAM.

Ashton Valve Co.....Boston.
Lunkenheimer Co..... Cincinnati.

WILFORD'S WATERPROOF CLOTH.

Bunker, E. A. .....New York.

WIRE ROPE AND WIRE ROPE FITTINGS.

Baker, H. H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

WINDLASSES.

American Ship Windlass Co..Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

WINCHES.

American Ship Windlass Co..Providence, R. I.
Georgian Bay Engineering Works..... .....Midland, Ont.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.

Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.

Donnelly Salvage & Wrecking Co..... .....Kingston, Ont.
Great Lakes Towing Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.

YACHT AND BOAT BUILDERS.

Drein, Thos. & Son.....Wilmington, Del.
Manitowoc Dry Dock Co.....Manitowoc, Wis.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

YAWLS.

Drein, Thos. & Son.....Wilmington, Del.

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Office of the Atlantic Mutual Insurance Company.

NEW YORK, January 20th, 1905.

The Trustees, in conformity with the Charter of the Company, submit the following statement of its affairs on the 31st of December, 1904.

Premiums on Marine Risks from 1st January, 1904, to 31st December, 1904,			$2,909,343.08
Premiums on Policies not marked off 1st January, 1904, - - - - -			724,151.84
Total Marine Premiums, - - - - - - - - - - - -			$3,633,494.92
Premiums marked off from 1st January, 1904, to 31st December, 1904, -			$3,016,978.35
Interest received during the year, - - -	$275,926.58		
Rent " " " less Taxes,	107,148.14	$383,074.72	
Losses paid during the year which were estimated in 1903 and previous years, - -	$318,124.29		
Losses occurred, estimated and paid in 1904, -	771,957.98	$1,090,082.27	
Less Salvages, - -	$142,418.20		
Re-insurances, - - -	84,094.99	$226,513.19	
Returns of Premiums and Expenses, $405,721.91		$863,569.08	

The Company has the following Assets, viz:

United States and State of New York Stock, City, Bank and other Securities,			$5,243,600.52
Special deposits in Banks and Trust Companies, - - - - - -			1,417,543.97
Real Estate corner Wall and William Sts., and Exchange Place,	$4,289,000.00		
Other Real Estate and claims due the Company, - - -	75,000.00		4,364,000.00
Premium notes and Bills Receivable, - - - - - - - -			1,020,087.28
Cash in the hands of European Bankers to pay losses under policies payable in foreign countries, - - - - -			241,710.47
Cash in Bank, - - - - - - - - - - - - - -			351,301.69
Aggregating, - - - - - - - - - - -			$12,638,243.93

A dividend of **Six** per cent. interest on the outstanding certificates of profits will be paid to the holders thereof, or their legal representatives, on and after **Tuesday** the **Seventh** of **February** next.

The outstanding certificates of the issue of 1899 will be redeemed and paid to the holders ahereof, or their legal representatives, on and after **Tuesday** the **Seventh** of **February** next, from which date all interest thereon will cease. The certificates to be produced at the time of payment, and cancelled.

A dividend of **Forty** per cent. is declared on the net earned premiums of the Company, for the year ending 31st December, 1904, for which, upon application, certificates will be issued on and after **Tuesday** the **Second** of **May** next.

By order of the Board,

G. STANTON FLOYD-JONES, Secretary.

TRUSTEES.

GUSTAV AMSINCK,
FRANCIS M. BACON,
JOHN N. BEACH,
WILLIAM B. BOULTON,
VERNON H. BROWN,
WALDRON P. BROWN,
JOSEPH H. CHAPMAN,
GEORGE C. CLARK,
CORNELIUS ELDERT,
EWALD FLEITMANN,
HERBERT L. GRIGGS,
CLEMENT A. GRISCOM,
ANSON W. HARD,
MORRIS K. JESUP,
THEODORE P. JOHNSON,
LEWIS CASS LEDYARD,
FRANCIS H. LEGGETT,
CHARLES D. LEVERICH,
LEANDER N. LOVELL,
GEORGE H. MACY,
CHARLES H. MARSHALL,
W. H. H. MOORE,
NICHOLAS F. PALMER,
HENRY PARISH,
FREDERIC A. PARSONS,
DALLAS B. PRATT,
GEORGE W. QUINTARD,
A. A. RAVEN,
JOHN L. RIKER,
DOUGLAS ROBINSON,
GUSTAV H. SCHWAB,
WILLIAM C. STURGES.

A. A. RAVEN, *President.*
CORNELIUS ELDERT, *Vice-President.*
THEO. F. JOHNSON, *2d Vice-President.*

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Geo. Stratford Oakum Co.

Jersey City, N. J.

Established 1860

Manufacturers of all grades of

OAKUM

SPUN COTTON

For Sale at Ship Chandlers Everywhere

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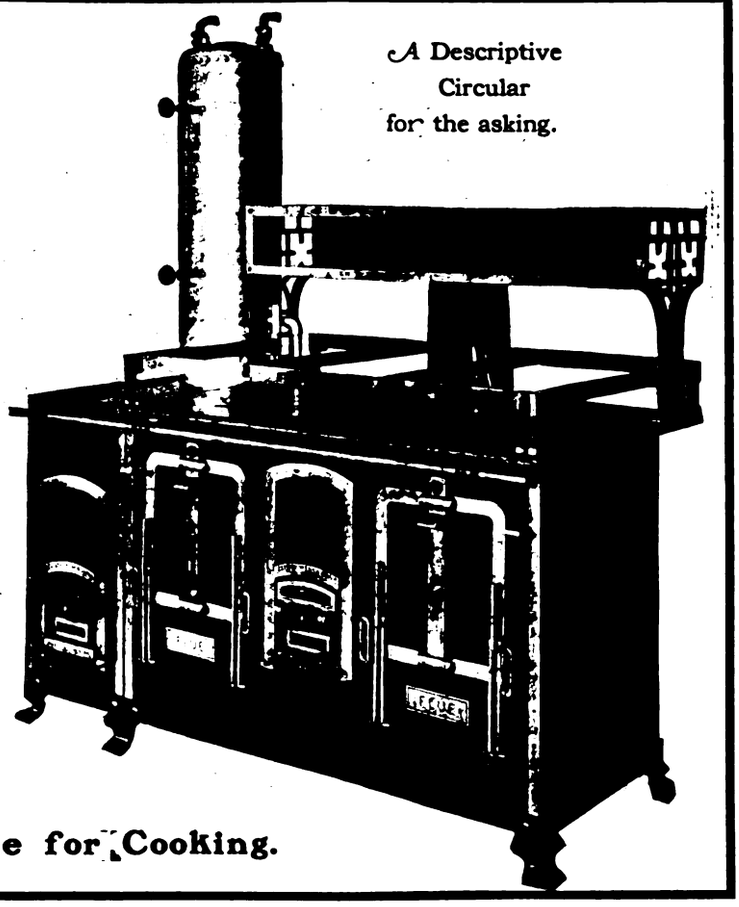

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